

HISTORICAL CORNER

THE ROYAL ACADEMY OF SCIENCES AND ARTS OF BARCELONA: AN HISTORICAL ACCOUNT*

Origin and inception

According to its founding charter, The Royal Academy of Sciences and Arts of Barcelona was established on January 18, 1764, as a private venture under the name Conferencia Physico-Mathematica Experimental (Experimental Physico-Mathematical Conference) by Royal Charter on December 17, 1765. It became the Real Conferencia Física and function as the King's consulting body for Catalanian affairs. The name was changed again on October 14, 1770, to Real Academia de Ciencias Naturales y Artes until another Royal Order on December 7, 1887 altered its name again to the present one of Real Academia de Ciencias y Artes. The October 22nd Decree 3533/1964 gave it the same rank as those Royal Academies established in Madrid. According to the April 9th Decree 120/1987, the Academy became legally linked to the Generalitat de Catalunya.

The Academy is an association of people interested in the study, advancement and applications of science. Its goal is to promote and act as a reference in the field of science and applied art. It is located on nr. 115 of the Rambla in Barcelona and housed in a building erected in 1894 by Mr. Josep Domènech i Estapà, a well-known architect of the modernist epoch who also designed the Fabra Observatory building.

New members of the Academy are elected by existing members who consider people of particular distinction in any of the sciences which the Academy cultivates providing they live in Barcelona or its suburbs. Election is carried out by secret ballot among members and the candidate must obtain a better than 50% majority.

The Academy is governed by the Governing Council that consists of a: President, Vice-president, Secretary General, Vice-secretary, Treasurer, Censor, Curator, and Librarian. Each person, regardless of office, is nominated by at least two Academicians and the Director of the Fabra Observatory (who is directly selected by the Council). The person is elected for a 2-year term and may be re-elected *ex-officio*. Members of the Council are the Directors of the seven Sections that makes up the Academy: Mathematics and Astron-

omy, Physics, Chemistry, Earth Sciences, Life Sciences, Technology and Fine Arts. These Directors are elected directly by the members of the corresponding Section. Each year, one half of the Council is renewed by secret ballot. For the President to be re-elected, a better than 2/3 majority is required.

There is also the category of corresponding members, for which the requirements are the same as above (except that of living in Barcelona). These members include both Spaniards and foreigners. All of them are distinguished scientists who live in European countries, North America, South America; two corresponding members are Nobel laureates.

Apart from Fr. Tomàs Cerdà, S.J., forerunner of the Conferencia and one of the earlier scientists who introduced Newtonian physics in Spain, as well as some of the founders such as Subirats and Bonells, many Academicians of the 18th century deserve mention. Four of them, however, stand out by their scientific contributions and as representatives of the Illustration. In the Principality of Catalonia and in Bourbon Spain of the 18th century: Francesc Carbonell i Bravo (1768 - 1837), chemist Antoni de Martí i Franquès (1750 - 1832), who excelled in the fields of chemistry and botany; Francesc Santponç i Roca (1756 - 1821), a physician and professor of mechanics; and Francesc Salvà i Campillo (1751 - 1828), physician.

Martí i Franquès is the author of a well-known paper *Sobre la cantidad de aire vital que se halla en el aire atmosférico y sobre varios métodos de conocerlo* (1786) («On the amount of vital air to be found in atmospheric air and on the various methods to find it») in which he determined the composition of air more accurately than Priestley and Lavoisier did, as acknowledged by the latter, and was warmly praised both in France and in Germany. Salvà i Campillo is well known for his papers on electricity and telegraphy. He constructed one of the first electric telegraphs.

After the Napoleon Wars (1808 - 1814) there was a fallow period. However, some scientists stand out: Antoni Llobet i Vall-Llosera, geologist, Maria de la Pau Graells, entomologists, Joan Agell, Theoretical Mechanics and Onofre Jaume Novellas, Astronomy. Later on, important figures are Francesc Xavier Bolós i Germà and Agustí Yáñez i Girona, a well-known chemist and former student of Bonell who was the first President of the Academy elected by its members. Previously, the President was *ex officio*, the highest military authority of the Principality, later this became the highest civilian authority. The sculptor Damià Campeny Estrany was

* **R. Parés**, President since 1995

J.M. Codina, Director Fabra Observatory since 1971

M. Puigcerver, Secretary General since 1977

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the first Fine Arts Academician (1838), the other members having always been pure scientists. The forerunner of the daguerreotype process, an early photographic process in which an image was produced on a light-sensitive silver or silver-coated plate and developed in mercury vapor, was introduced to the Academy thanks to Pere Felip Monlau and J. Balcells awakened the interest for steam-driven sailing.

Between 1860 and the beginnings of the 20th century, several notable scientists emerge, such as geologists Jaume Almera and Artur Bofill i Poch, particularly their work on the geological map of Catalonia. Also in the field of Geology, Lluís Maria Vidal i Carreras, Director of the *Mapa Geológico de España*, who became President of the Academy between 1910 and 1912. There is a truly impressive list of Catalan botanists related to the Academy, both in the 19th century and at the beginning of the 20th. Foremost among them is, Antoni Cebrià Costa and Estanislau Vayreda i Vila as well as Pius Font i Quer. Fr. Navas was also noted in the field of entomology.

It would be difficult to comment summarily on the most important Academicians of the 20th century, but surely among them would be Josep Comas i Solà's work in astronomy, Eduard Fontserè in meteorology, Esteban Terradas in physics and engineering, and Josep Pascual Vila in organic chemistry. There are many others in the field of basic sciences and also in architecture, engineering, applied arts and fine arts.

Activities

Since its founding in 1764, and with very few intermissions, the Academy holds monthly scientific meetings for the presentation and discussion of research works by its members. If they so wish, and the Governing Council agrees, these papers are published in the form of *Memorias de la Real Academia de Ciencias y Artes de Barcelona* (Memoirs of the Royal Academy of Sciences and Arts of Barcelona).

In addition, the Academy carries out scientific reports on matters of its domain, either when consulted or on its own initiative. From time to time the Academy sponsors a series of



Figure 1. The display cabinet on the right houses the Academy collection of ancient scientific instruments.

public lectures by qualified researchers, who may or may not be members, on scientific subjects of popular interest. These lectures are published whenever possible. The last two lecture series dealt respectively with stratospheric ozone and the «ozone hole», published in 1990, and with the issue of the delta of the Ebro river, published in 1995.



Figure 2. Astronomical clock built in 1869 by Albert Billeter, a Swiss watchmaker working in Gràcia quarter, Barcelona.

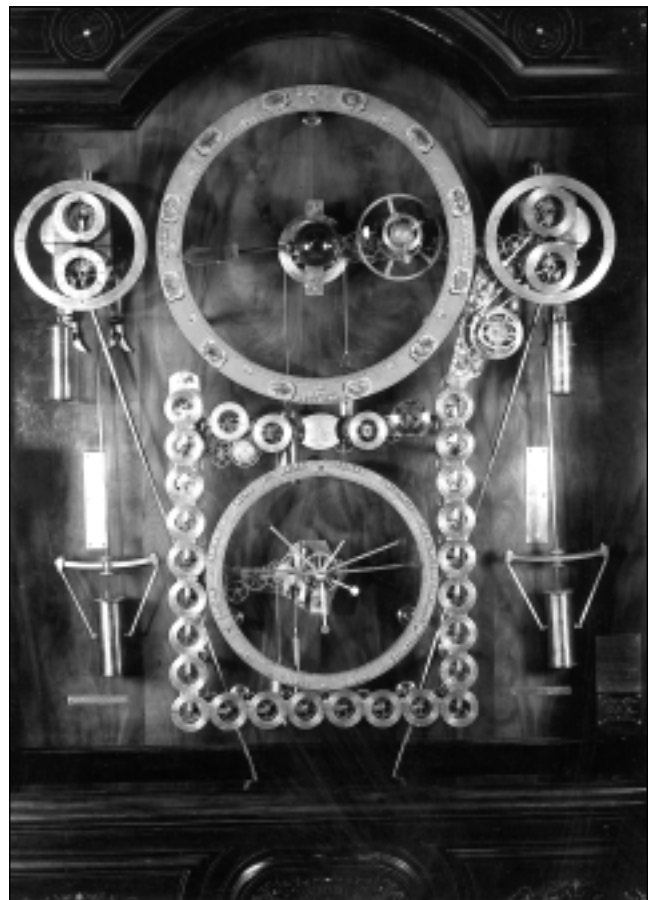


Figure 3. Frontal view of Billeter clock. Dials on the upper-left corner show Barcelona time (hours, minutes and seconds). Those on the upper-right corner show sidereal time and equation of time. Center upper large dial shows zodiac sign and relative positions of Sun, Earth and Moon. Center lower dial shows positions of planets and constellations. The upper row of small dials show day of the week, day of the month and year. The rest show local time of 24 cities around the world.

Also, scholarships have been granted to bright students in the past and prizes for young researchers have been sponsored.

The Academy also owns an interesting collection of old scientific instruments (Fig. 1), among them several interesting clocks (one of them shown in Figs. 2 and 3), and an important artistic patrimony; both collections are periodically open to the public.

Standard Time Service

Since 1886, when Mr. Angel del Romero was President, the Academy has kept in operation a standard time service for public information. This was started in order to establish and make available to the public a precise standard hour for the city of Barcelona, as there was not such a service at the time.

The standard hour furnished by the clocks of the Academy was declared «legal time» for the city in 1891. Under the care of the Academy, Prof. Eduard Fontserè and the clock-maker Mr. Adolf Juillard, gave the city a very useful service as it assumed control of public clocks. In 1984, the City Council added the care of the Cathedral and Town Hall clocks. Additional clocks in the city were added at a later date.

Apart from the time-conscious citizens of the early 1900s, the main users of the service came from two guilds: watch-makers, who, not surprisingly, were interested in keeping as accurate a time as possible, and sailors, who at that time had to rely on their chronometers in order to determine geographical longitudes.

In 1893, the construction of the façade of the Academy premises, which included two small observing towers, were completed. Thanks to an important grant by the Country Council, proper instruments to carry out the astronomical observations could be purchased.

Even though very different conditions prevail at present concerning dissemination of the standard time, the Academy has kept in operation its service which now operates with modern instrumentation able to furnish the time within a tenth of a second.

Library and Publications

The Academy maintains a library which comprises over 100,000 volumes and is particularly interesting in regards to funds of the second half of the 18th century. It is a special field of interest and one of the best in Spain. Historians and researchers (Fig. 4) often consult it.

The Library also keeps most of the Academic papers as well as those of other prominent scholars. Most Academicians have donated their private scientific or technical ones to the Library.

An important programme to computerise the bibliographic funds is in progress in order to expedite their consultation,



Figure 4. Main reading room of the Library of the Academy.

improve service to readers, and establish an easier connection with other libraries.

The Academy publications deserve a special mention. They started in 1786 with a series presently known as *Publicaciones científicas no periódicas* (Non-periodic scientific publications), which comprises 47 issues, the last of which describes, the 1914 commemoration of the 150th anniversary of the Academy.

The main publications, however, are the *Memorias* (Memoirs), which are the regular vehicle of communication of scientific, technical or artistic papers presented before the Academy. They started in 1835 and comprise three epochs, while preserving the original aspects, their format has evolved and in January 2000, number 962 was published. About 10 to 15 memoirs are published each year. With very little delay, these memoirs are sent on an exchange basis to approximately 400 Academies, Libraries and similar institutions. 200 of them are Spanish the remaining institutions are foreign. The memoirs are also sent to Academicians, both local and corresponding ones, so they enjoy a considerable diffusion.

Another publication is the *Nómina-Anuario*, a yearbook which records the Academy news, the names of Academicians and their distribution in Sections. It also includes a complete historical list of its Presidents, the reports of activities both of the Academy and the Fabra Observatory as well as obituaries when necessary.

The Academy is also responsible for the yearly publication of the *Boletín del Observatorio Fabra*. This publication started in 1919 and contains a summary of the observations of different kinds of work carried out there.

The Fabra Observatory

One of the peculiarities of this Academy is that it owns and runs the Fabra Observatory, which was built near the summit of Mount Tibidabo (one of the hills that surround Barcelona) between 1902 and 1904. The bequest by the R. Hon. Camil Fabra Fontanills, 1st. Marquis of Alella, enabled the Academy



Figure 5. Main entrance to the Observatory Fabra building. Also built by Architect and Academician Domènech i Estapà, was inaugurated in 1904. It is located near the summit of the Mount Tibidabo, one of the hills that surround Barcelona.



Figure 6. The main hall of the Fabra Observatory

to buy the terrain, erect the building and purchase the main telescope. The City and Provincial Councils also helped.

The building, on Camí de l'Observatori in Barcelona, was designed and its construction directed by Architect and Academician Mr. Josep Domènech i Estapà (1858- 1918) He was advised on technical matters by Academician Mr. Josep Comas Solà, later to become the first Director of the Observatory. The building consists of two main sections: the first, consists of an octagonal outer base and a cylindrical internal structure upon which the 10-m dome rests (Fig.5) and a semi-detached rectangular section which accommodates the main hall (Fig.6), meridian-telescope room, library, computer room, and the meteorology and seismology rooms.

Between 1991 and 1992 the Direcció General d'Arquitectura i Habitatge del Govern de la Generalitat, authorized an extensive refurbishing of the observatory. This work, under the direction of Architect Mr. Francesc Vayreda i Bofill, has taken special care to respect the original style and some details have even been recovered which time and erosion had obscured.

The Work of the Observatory

Since its inception, the Observatory has been working consistently along three main lines: Meteorology, Seismology, and Astronomy. Its Directors have been outstanding person-

alities in the local scientific world, such as Mr. Josep Comas i Solà, Dr. Eduard Fontserè i Riba, Dr. Isidre Pòlit i Buxareu and Dr. Joaquim Febrer i Carbó. The present Director is Academician Dr. Josep M. Codina i Vidal.

The first Director of the Observatory, Mr. Comas i Solà, discovered eleven minor planets (Hispania, Barcelona, Gothlandia, Comas Solà, Pòlit, etc.) and two comets, one of them periodic. Dr. Isidre Pòlit discovered another minor planet, and two variable stars have also been detected at the Observatory.

Astronomical Section

The Observatory's main focus is astrometry, that is, the high-precision determination of the positions of heavenly bodies, such as minor planets and comets (Fig. 7). This work is carried out within the international astrometric network, in which more than a thousand Observatories co-operate. The Fabra Observatory figures in the select group of older observatories and still carries out its observational activity from the same original site.

The astrometric observations of minor planets, as well as the precision positions, are sent to the two international collecting centres: the Minor Planet Center of the Smithsonian Astrophysical Observatory, Cambridge, MA, USA, and the Institute of Theoretical Astronomy of St. Petersburg, Russia. For the determination of precise positions, a visual and photographic Mailhat telescope, (38 cm diameter) is used. This «long focal astrograph» (over 4 m focal distance) is required for high-precision astrometric observations (Fig. 8) and it is the largest in Spain within its class as well as being among the first in operation in Europe. This instrument is complemented with modern Zeiss equipment that is able to measure the co-ordinates of images on the photographic plates to an accuracy of a thousandth of a millimetre. Quite recently, a Cestron telescope has been acquired, with optical characteristics similar to the Mailhat's but is equipped with a

OBSERVATORY CODES

THIS LIST SUPERCEDES MPC 2055, 2056 AND 2568

000 GREENWICH
001 CROWBOROUGH (ROBERTS)
002 RAYLEIGHT (VANLOOY)
003 MONTPELLIER
004 TOLOUSE
005 MEUDON

006 FABRA OBSERVATORY, BARCELONA

007 PARIS
008 ALGIERS
009 BERNE-UECHT

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997 HARTWELL
998 LONDON-MILL HILL
999 BORDEAUX-FLOIRAC

Figure 7. List of Observatories in the World Astrometric Network of the International Astronomical Union.



Figure 8. Main equatorial telescope installed at the Fabra Observatory.

CCD camera (i.e., an electronic plate) for astrometric observations using digital photography techniques.

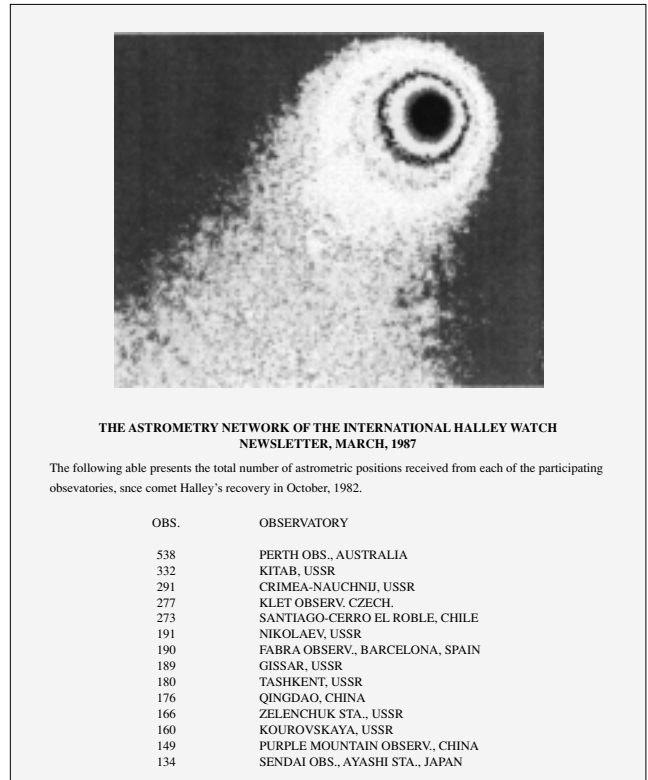
Astrometry of comets, also carried out within the International Astronomical Union, is done by tracking the most important comets discovered or visible each year. Among the most notable campaigns recently carried out by the Observatory, has been the tracking of comets Giacobini-Zinner and Halley in 1985 and 1986 as well as that of comets Hyakutake and Hale-Bopp in 1996 and 1997. (Fig. 9).

Meteorological Section

The Observatory carries out four complete observations a day according to international regulations: 00, 07, 13 and 18 hours UCT. The most important meteorological variables are observed: temperatures, precipitation, wind direction and speed, humidity, atmospheric pressure, evaporation, sunshine duration, visibility and cloudiness (class, amount and height of cloud base).

Two remarkable features of this Section are:

- 1) Since the series of daily observations began on October 1, 1913, they have always been carried out at the same site and without any interruption- even at times when law and order were in jeopardy, such as the Civil War of 1936 - 1939. The observations are of particular value because it encompasses an uninterrupted period of 86 years (Fig. 10). In addition, the surroundings of the Ob-



Entre 130 observatorios el Fabra ocupó el séptimo lugar por el número de observaciones realizadas sobre el cometa HALLEY'S. Su eficacia en las tareas de Astrometría es reconocida por todas las organizaciones internacionales.

Figure 9. Fabra Observatory was ranked 7th according to the number of observations of Halley's Comet. The quality of its task in Astrometry is recognized by all international organizations.

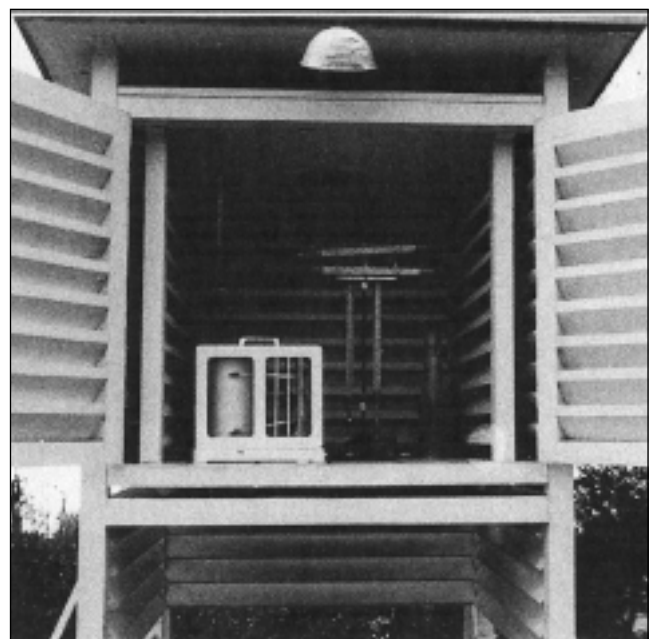


Figure 10. A meteorological shelter showing some of the instruments inside. Meteorological observations began in 1913 at the Fabra Observatory and have continued without any interruption at the same site.

servatory have not changed substantially, which is not the case for other meteorological stations in the city.

- 2) A Jardí rate-of-rainfall recorder, invented by Academician Dr. Ramon Jardí, Professor at the University of

Barcelona, (Jardí, 1921; Fontserè, 1922) and manufactured by Richard Frères of Paris, was installed in 1927 and has been working ever since. The rainfall-rate data bank, made up by the Jardí instrument recordings, is doubtless one of the very few of its kind existing among the world observatories. Several Academicians and collaborators have used it in researches concerning attenuation of microwave propagation and urban hydrology.

Seismology

The Observatory also does its share of seismological work. It records earthquakes anywhere in the world, but its main interests lie in regional seismicity such as: determination of epicentral distances, calculation and location of epicentres, the distribution and the determination of magnitudes. This work is done in permanent collaboration with the seismological section of the Geological Survey Department of the Autonomous Government.

Seismological instrumentation is located either at the Observatory itself (1) and (2) or elsewhere (3) and consists of:

- 1) Classical long-period seismographs Mainka, of two horizontal components, and short-period, vertical component Vicentini; all of them are low-sensitivity and use mechanical smoked-paper recording.
- 2) Short-period Mark-Lennartz seismographs (vertical and horizontal components) with electronic pen and paper recording.
- 3) Three-component Teledyne-Geotech short-period, high-sensitivity seismographs are located at the Montseny Massif and connected through radiotelemetry with pen and paper recorders at the Observatory.

With the above equipment, approximately 300 to 400 earthquakes a year measuring different magnitudes, intensi-

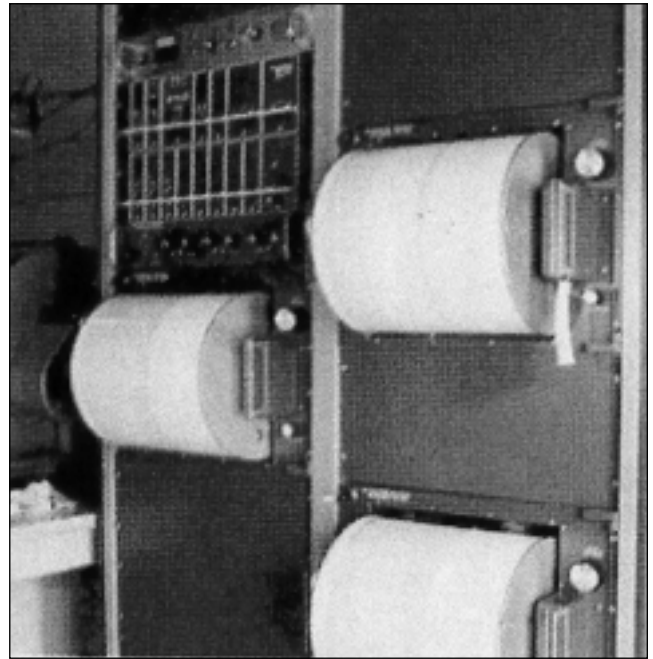


Figure 11. Analogical recording equipment for seismographs.

ties and epicentral distances are recorded every year (Fig. 11). While the Observatory does its share of world seismology, its main concern lies in regional seismicity. This work is done in close collaboration with the seismological section of the Geological Survey Department of the Autonomous Government.

Public Information

In addition to its scientific work, the Observatory also carries out scientific and cultural education tasks mainly through guided tours of its installations. It also serves the city by furnishing any data that is required.