

# MADRID: Technology Capital, Open for Business



<p>Comunidad de Madrid</p> 	<p>Fundación para el Conocimiento Madrid+d</p> 	<p>Universidad de Alcalá</p> 	<p>Universidad Carlos III de Madrid</p>  <p>UNIVERSIDAD CARLOS III DE MADRID</p>
<p>Universidad Complutense de Madrid</p>  <p>UNIVERSIDAD COMPLUTENSE MADRID</p>	<p>Universidad Politécnica de Madrid</p> 	<p>Universidad Rey Juan Carlos</p> 	<p>Universidad Autónoma de Madrid</p> 
<p>Centro De Biología Molecular Severo Ochoa</p> 	<p>Institute Of Biomedical Research Alberto Sols IIB</p> 	<p>Parque Científico de Madrid</p> 	<p>Universidad Nacional de Education (UNED)</p> 
<p>Universidad Europea de Madrid</p>  <p>UNIVERSIDAD EUROPEA DE MADRID Laureate International Universities</p>	<p>CIEMAT (Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas)</p> 	<p>Centro Nacional de Investigaciones Oncológicas (CNIO)</p> 	<p>Council of Scientific Research (CSIC)</p> 

**Centro De Astrobiología**



**Tecnicas Reunidas**



**ATECMA (Spanish  
Association of Aerospace  
Industries)**



**IFEMA - Feria de Madrid**



# MADRID: Technology Capital, Open for Business



## Madrid: Technology capital, open for business



Esperanza Aguirre Gil de Biedma, *President, Madrid Regional Government*



Canal Isabel II water tank.

I'd like to begin by calling your attention to an evident fact that very frequently goes unnoticed.

What I'm referring to is the role of the scientist, the businessman and the investor in today's society. These three figures, an unrecognized driving force behind all progressive and avant-garde trends, have been and will be necessary to free mankind from a natural environment seen as hostile and incapable of satisfying our basic necessities and desires.

Proof of this is the fact that our scientists, businessmen and investors have changed our whole relationship with our natural environment. We are no longer protecting ourselves from it, as we did only a hundred years ago. We try to preserve it, so that it will continue to sustain us and our progress in the future.

Due to the oblivion that sometimes enshrouds these three figures throughout the history of mankind, we tend to forget another fundamental truth: that the only insufficient resource is knowledge to satisfy our needs in cheaper and more useful ways. In other words, what fails is the human factor transforming nature's unknown properties and uncontrollable phenomena into sources of energy and productive resources.



Center of Molecular Biology.

Consequently, a government's main objective in this field would be, on one hand, to promote creation and scientific research and, on the other, to create an ideal atmosphere of confidence and legal security apt for the development of an economic and entrepreneurial initiative, with the necessary contact and collaboration between researchers, businessmen and investors.



National Center of Biotechnology.

A good example of this human factor is the region of Madrid itself. Poorly endowed with natural resources, having soil inadequate for agriculture and a subsoil low in mineral content, Madrid is nevertheless Spain's richest and most prosperous community, probably due to the fact that its open and amiable character has always attracted Spain's best brains.

With the foundation of the Complutense University, attended by cultural figures such as Antonio de Nebrija, Juan de Mariana and Francisco de Quevedo, Madrid began a long tradition in education and intellectual production that, fortunately, seems here to stay. According to the compiler Pascual Madoz, the people of Madrid possess "a clear wit and a precocious talent". Of all the "Sociedades Económicas de Amigos del País" that appeared in the eighteenth-century, Madrid's was, if not the first, undoubtedly the most distinguished. And our capital was also the birthplace of the Institución Libre de Enseñanza.

To promote quality in education and research is one of the main intentions of the government of the Community of Madrid, which at present has the necessary capital and initial investments, with 13 universities (6 of them public) and a large number of research centers, complemented with an equally notable entrepreneurial activity, meeting the demands of capable professionals for specific answers to their challenges and immediate problems.



Residencia de Estudiantes-Hall of Residence.



Faculty of Medicine.

We are conscious of the work that lies ahead, but much is done already, as the facts of Madrid's scientific production would suggest.

Madrid has the basics. It produces science and creates knowledge in quantity and quality. But to transform this scientific knowledge into more prosperity and well-being, we need the other two cornerstones that I mentioned at the beginning: more businessmen and investors willing to take advantage of Spain's richest and most prosperous region. Today, Spain's economic, scientific and technological capital -- as *Scientific American* so aptly coins it in this special section -- is "Open For Business".

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fundación para el  
conocimiento  
madríd

Fundación para el Conocimiento Madri+d

## Madrid, a city open to science and technology



Luis Peral Guerra, Minister  
of Education, Madrid  
Regional Government



Metallurgical National Research  
Center.

*"We only see what we know"*  
Johann W. Goethe

When we consider Europe's science and technology, we normally set our sights on the northern countries. Likewise, when we think about Spanish culture and economy, its art, literature or tourism will conceal other realities that are just as true, though maybe less evident.

As far as memory goes, other dominant stereotypes will probably make us forget that Spain restored the values of ancient Greece that sustain our modern western world, and that during four centuries, Spain made an enormous scientific and organizational effort in order to manage a huge empire divided by a huge ocean.

An average well-informed person knows Madrid's Prado Museum, but very few know that its building was meant to be a research center and that it's surrounded by institutions, many of them active today, that constituted one of the European Enlightenment's great scientific projects.

Many times destroyed and rebuilt since then, Madrid still defines itself by its commitment to science. It has been, and still is, a space open to science and technology.

In these last twenty-five years, few cities have suffered the strain of being the capital of an autarchic, dictatorial and centralist country suddenly transformed into the capital of a modern, totally democratic nation, included in the European Union and with one of the most decentralized territorial organizations in the world. Furthermore, this transformation has been accompanied by the increasing welfare of its citizens and a national and international economic leadership.

The Community of Madrid's GDP has experienced a steady growth between 1995 and 2003, with an annual average increase of 3.7%, surpassing the European Union and the United States.

Madrid's wealth stems from its own identity: a cosmopolitan, enterprising and committed culture that has stimulated the fusion of scientific creativity and entrepreneurial risk. Science, business and welfare form a virtuous circle that makes Madrid one of the European Union's most attractive regions, both for students and researchers, as for businessmen and investors.

Its 210,000 college students, 20% of them outside the Madrid area, and 30,000 persons dedicated to research and development, represent the strength of its human capital.

An important investment in research and development (60% of it contributed by private companies) and in secondary education, have given Madrid a solid infrastructure totally integrated in the European Research Area, as can be seen in the following pages.



Geomining College.



Imperial College.



Royal Observatory.

Scientific capacity and productive activity in well-established high-tech sectors like the space industry, drug manufacture or the telecommunications business, or in rising sectors like biotechnology or nanotechnology, establish Madrid as an active member of the global network of cultural metropolises.

For this reason, the regional administration, accepting *Scientific American's* invitation to open and lead this special section, has tried to make a point of Madrid's commitment to culture and prosperity or, in other words, to science.

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# MADRID: Technology Capital, Open for Business



## The door to your future



Facade of the Rectorate.  
Photo: Miguel Ángel Prado Domínguez.

The University of Alcalá is one of the oldest within the European Union. Founded in 1293 as a center for "general studies", it became consolidated as a university in 1499, when the regent of the Kingdom of Spain (Cardinal Cisneros) developed it as a real educational project, absolutely innovative, on which the New World universities were based and made real the Spanish "Golden Century" of literature.



Interior of the Rectorate.  
Photo: Miguel Ángel Prado Domínguez.

From its establishment, the University of Alcalá considered the core for its academic excellence to be in its classrooms, presided over by the most relevant masters, nowadays considered key players in the history of Spain, such as the theologians and ecclesiastics St. Ignacio de Loyola and St. Juan de la Cruz. Because of the university's foundation in Alcalá de Henares, where Miguel de Cervantes was born, the King of Spain every year at the Assembly Hall of our University bestows the most important award for literature written in Spanish -- the "Cervantes Prize".

The singularity of its academic model, its historical contribution to letters and the sciences, as well as the beauty and historical wealth of its buildings caused the University of Alcalá to be declared by UNESCO "Heritage of Mankind" on December 2, 1998. That is why the University of Alcalá pays special attention to: the teaching and care of our language (a symbol of which is the mentioned "Cervantes Prize"); the growing and strengthening of our very special links with Latin America; the building up of the "Europe of Knowledge" (European Harmonization Programs and Erasmus); the maintenance and preservation of our historical heritage; the promotion of environmental protection and integration of its related programs within the framework of the Henares and Guadalajara lands, as well as collaboration with the most innovative companies through the Technology Park inside our campus.



Assembly Hall of the university.

The modern University of Alcalá includes 9 faculties and 8 polytechnic schools which cover a vast area of knowledge ranging from humanities, social sciences and law to experimental science in the fields of chemistry and medicine as well as engineering and architecture.

To properly and effectively address that huge teaching challenge, the University relies on 43 departments located on three campuses, two research institutes and fifteen centers. Resulting from that teaching and research activity, nowadays the University of Alcalá employs more than 1,600 researchers, has signed 114 agreements and protocols with companies and other public as well as private institutions, 172 research projects funded by the Government (both central and regional), 11 Pan-European projects (within the European Union) and 26 patents granted.

Some relevant examples of the fruitful and vast research activity being pursued at the University of Alcalá are:

- In the field of **Solar Energetic Particles and their Interaction with the Terrestrial Environment**: the main activity is concentrated in the experimental determination of the particle fluxes and of the elemental and isotopic composition of Solar Energetic Particles and Anomalous Component of Galactic Cosmic Rays in order to investigate their characteristic of propagation, acceleration and modulation process as well as their interaction with the Earth's environment. By continuing exploiting these results, models of particles and magnetic clouds propagation are being developed to be able to forecast geomagnetic storms, with particular focus on space weather.
- In the field of **Relevance Theory and Formal Grammar**: the activity is focused on syntax-semantics and semantics-pragmatics interfaces as well as on general linguistics, lexicology (meaning-relations: synonymy, antonymy and hyponymy), lexicography and phraseology (idioms).
- Within the area of the **Paleontology**: one of the most relevant research lines is



Caracciolos College.



- addressed to investigating the origin of human speech through the analysis of the auditory capacities in Middle Pleistocene fossil humans from the Sierra de Atapuerca.
- In the **Laboratory of Immune System Diseases and Oncology**: the CSIC and the University of Alcalá, using a translational medicine approach, are taking advantage of the molecular and cellular mechanism discovered *in vitro* and in preclinical animal models of human diseases to propose prognosis biological markers of disease evolution in individual patients, to design novel therapeutic approaches and investigate an effective drugs class.
  - In the field of **Electronic Technology**: the main research lines fall within the area of robotics such as the work being developed on autonomous ground vehicles; sensors for infrared, ultrasonic and vision; vision-based systems for robotics and for assisted driving; control and advanced digital system design, and last but not least, biomedical engineering, such as telemedicine and surgery robotics.
  - Our **Environmental Economics Research Group** has a long tradition in the field of economics of natural resources and the environment. The *Economic Valuation of Environmental Impacts from Power Generation in Spain*, the *Design of an Artificial Flooding Regime (Flushing Flows) in the Lower Ebro River* and the *Economic Valuation of the Acoustic and Light Impact of the Madrid/Barajas International Airports* are a few examples that show the leadership of the University of Alcalá in this field.
  - In the field of **History**, one of the main research lines includes projects about the Catholic Movement and Catholic Action, as well as Social and Political Catholicism.
  - The research at the **Department of Geography** comprises the execution of projects in the field of remote sensing and GIS applications to environmental problems, deforestation, catastrophe prevention and biophysical variables estimation.

The variety and extensive number of unique projects, as well as the specific resources devoted to them, position the University of Alcalá as the "benchmark" for quality research in Spain and in Europe.





UNIVERSIDAD CARLOS III DE MADRID  
[Universidad Carlos III de Madrid](http://www.uc3m.es)

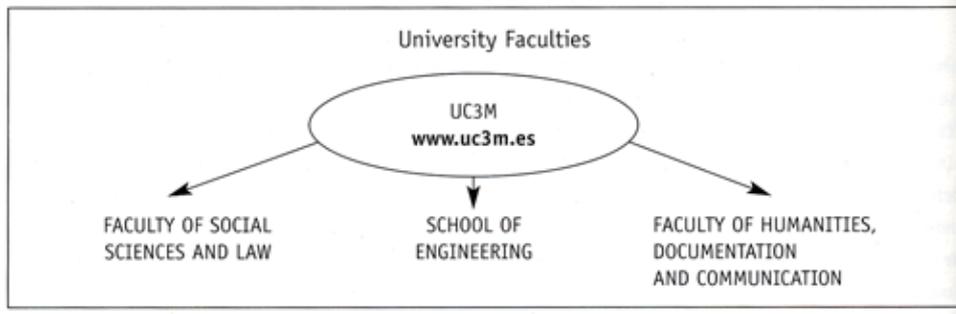
## Universidad Carlos III de Madrid: Open to new challenges



The Community of Madrid has awarded for the second consecutive year, the Certificate of Quality to Universidad Carlos III de Madrid Library.



Portable robot for serving disabled people, developed by Robotics Lab of Universidad Carlos III de Madrid.



Rooms equipped with Wi-Fi and laptop computers are only some of the services offered to complement the quality of our programs and to facilitate job placement for graduates.

### A balanced educational model

Universidad Carlos III de Madrid offers an innovative educational concept which promotes quality and excellence in teaching. Our primary objective is to provide an integral educational experience for the student through an educational model where the professional training and personal development of the student are in balance.

Universidad Carlos III de Madrid (UC3M) contributes, with all of its human and material resources, to the education of professionals for the job market of the 21st century, capable of critical thought and committed to the needs of society. This educational framework allows us, year after year, to reach high levels of job placement. Currently, more than 95% of our graduates find work within one year of graduation. Research activity, an ongoing connection with the world of business and professionals, as well as a distinguished international vocation are also characteristics of our institution.

UC3M is comprised of three campuses. The facilities include libraries specially oriented to support teaching, learning and research; fully equipped language laboratories; an auditorium with a seating capacity of more than 1,000 that features a year-round cultural program; and sports facilities for all members of the university community. Residence halls in all these campuses are designed to guarantee an integrated education for the student, facilitating learning, research, co-existence and participation in cultural, artistic and sports activities.

### Research: The Driving Force of Progress

Scientific and technological research, one of the primary objectives of Universidad Carlos III de Madrid, is made possible through the growing activity carried out in all areas and disciplines in our academic environment. *The abilities of our research groups have given us an excellent reputation for efficient research, well above the average of other Spanish universities.* This is clearly seen in both the volume of scientific production as well as the outside resources which are involved; in the last year there was 44% growth, with clear trends for future expansion.

Most projects are strategic in nature, competitively financed, highly applicable and with a clear

orientation towards industry. Research in the areas of social sciences, law and humanities, including multi-disciplinary projects, is of great importance. Further, the university leads scientific and technological projects of such scope as E-lane, for the development of the information society in Latin American (programa@LIS), or the network of excellence (e-next) on information technology, funded by the VIth Framework Program of the European Union.

UC3M participates in many research programs, and while those developed within the European Union Research Framework Programs are especially relevant, the direct contracting of our activities through public and private agencies is also of great importance. The university's support for research is complemented by a self-financed program which increases each year.

The experience and skills of our experts are available to businesses and institutions to answer scientific and technological questions, offering a portfolio of technological innovations developed at the university which are prepared for industrial or commercial exploitation.

#### **From Research to Businesses**

The creation of the Science Park, *Leganés Tecnológico*, represents another step forward in the scope of the university's research program. The park is based on proven models, adapted to real needs in order to achieve competitive excellence for the companies involved and thus contribute to the environment of social and economic development.

The Science Park is a point of reference in its areas of specialization: information technology; telecommunications; advanced industrial processes and advanced materials. The university's strong links with members of the national system of innovation and its relationships with Europe and Latin America, and the strategic location of the Science Park itself, make it an excellent starting point for cooperation among those involved in R&D.

#### **Quality in Postgraduate Studies: a Guaranteed Investment**

Nearly 1,000 students (of which more than 25% are foreign citizens) have completed postgraduate studies at our university. Specialized faculty, dynamic teaching methods, job placement service, collaboration agreements with companies, rooms equipped with Wi-Fi and laptop computers are only some of the services which are offered to complement the quality of our programs and to facilitate job placement for graduates.

*For the second consecutive year, Universidad Carlos III de Madrid has obtained the highest percentage of Quality Mentions (Mención de Calidad) in its doctoral programs awarded by the Ministry of Education and Science.*

#### **The International Vocation of UC3M**

The vocation of Universidad Carlos III is clearly international. The collaboration agreements signed with some of the most prestigious European universities, with those in America and in other parts of the world give students, researchers and faculty greater mobility and the opportunity to participate in international projects and university networks. The university has also been a pioneer in designing bilingual undergraduate and graduate programs (Spanish-English) and in offering programs of Spanish language and culture.

For further information: [www.uc3m.es](http://www.uc3m.es)





UNIVERSIDAD COMPLUTENSE  
MADRID  
[Universidad Complutense de Madrid](http://www.ucm.es)

## The Universidad Complutense de Madrid: Shaping the future



Restoration of ancient documents.



Sculpture dedicated to Cardinal Cisneros, founder of the Universidad Complutense.



*Los portadores de la antorcha*, sculpted by Anna Hyatt Huntington, represents the transmission of knowledge and is the emblem of the Universidad Complutense.

### The UCM in Figures

Teaching and Research Staff	5,915
Administrative and Service Staff	3,540
Students in Faculties and University Schools	72,112
Students in Doctoral Programs	11,576
Students in Special Complutense University Degree Programs	6,259
Students in Associated Centers	12,181
Annual Budget	€ 464 million
Official Degree Programs	77
Doctoral Programs	200
Special Complutense Degree Programs	225

Over its 500 year history the Universidad Complutense de Madrid (UCM) has shaped the cultural, political and scientific life of Spain. Men of science such as Ramón y Cajal and Severo Ochoa, humanists, writers and film directors like Ignacio de Loyola, Quevedo, Luis Buñuel and Amenábar, politicians and statespersons including Javier Solana, Rodrigo Rato, Princess Cristina and the future Queen of Spain have studied or worked at the UCM. For centuries, teaching at the UCM has been the most prestigious distinction for a professor in Spain. Our beautiful campus, with a million square meters of green space, situated inside the city of Madrid, the wide range of degrees and the quality of education make the UCM the university with the most applications for admission in Spain.

We offer degrees ranging from the most classical disciplines of the humanities to the most modern of science and engineering. Also worthy of mention are our magnificent School of Dentistry, the Medical School with four associated hospitals, the Veterinary School with its excellent Animal Hospital and the Fine Arts School, both the only of their kind in the Madrid region.

But, most importantly, building on the foundations of our brilliant history, the UCM looks toward the future. We are strongly committed to achieving the highest standards of quality in teaching, research and services. We are engaged in cooperation agreements with more than two hundred of the most important universities worldwide. The UCM is the only non-American university that sponsors its own center on the Harvard University campus: the Real Colegio Complutense at Harvard, visited each year by numerous Spanish professors.

We are home to some of the best research groups in the country, and we are on the cutting-edge of research in many areas. Our technological scientific infrastructure, together with the quality of our researchers, has established our laboratories and teams as leaders in many fields, among which are the following:

- **Animal Health:** The UCM has the only university laboratory authorized to produce autovaccines. Moreover, we have just opened a new high security laboratory (P-3 level) for the study of microorganisms.
- **Archeology:** The Universidad Complutense is leading important archeological excavations, like those at Atapuerca (Burgos) that discovered Homo antecessor, ones in Pinilla del Valle (in the north of Madrid) and in Tanzania.
- **Musicology:** The university, through the work of the Complutense Institute of Musical Science, preserves and publishes musical scores by classical Spanish composers.
- **Brain Cartography:** The UCM has the only center of magnetoencephalography in the country, which collaborates with similar centers worldwide. We also have a PET center on campus with a small synchrotron for the production and investigation of radio pharmaceuticals.
- Our **Electron Microscopy Center** is among the best three in Europe, and we also possess the best teams in **Diffraction, X-Rays and NMR** (Nuclear Magnetic Resonance) for molecular analysis.
- **Bioscience:** Our genomic and proteomic centers are equipped with modern technology for DNA sequencing and identification of genes and proteins; we have the only horizontal imaging equipment for biological research in Spain and we are conducting important research in the use of cannabinoids in the fight against cancer.
- **Post Traumatic Stress:** The UCM has been a leader in providing psychological help to those affected in the March 11 terrorist attack in Madrid and has undertaken a large-scale research project on its post-traumatic effects in cooperation with similar teams working on the effects of the September 11 attacks in New York.
- **Biodiesel production:** Using 100% Spanish technology, the UCM has provided the know-how for the first industrial plant that produces biodiesel fuel.

In addition, the UCM has the best university library in the country and its historical collection is the most important in Spain after that of the National Library. We publish more than 50 scientific journals covering all fields of learning.

In recent years, the UCM has striven to encourage technology transfer and technological development in the Madrid region. In 2003, the UCM received outside research funding equivalent to \$60 million, and the volume of contracts signed with private business grew by more than 30 % that year. We are promoting and fostering the creation of spin-off companies of a scientific and technological nature through the Madrid Science Park, a joint enterprise with our neighbor, the Universidad Autónoma.

We are convinced that the future of the UCM lies in the attracting the best minds. For this reason we offer our own system of doctoral grants in some of our more than 200 graduate programs. We want to retain the best researchers, paying special attention to the youngest ones. Without doubt, UCM is a great scientific center, located in the heart of Madrid, and welcomes all visitors who wish to contribute to progress in all fields of knowledge or to contact specialists in these fields.



Research is one of the main activities at the Universidad Complutense.



## Universidad Politécnica de Madrid (UPM): A university committed to technological innovation

[Universidad Politécnica de Madrid](#)



Site of Mining Engineering School in an historic building.

### UPM: A university blending history with advanced technology

Universidad Politécnica de Madrid (UPM) was founded in 1971 although most of its centers are over a hundred years old, having been founded in the 18th and 19th centuries, and existed independently until they were grouped together in the UPM.

The University currently numbers more than 40,000 students, 3,300 faculty members and around 1,000 staff engineers and postgraduate fellows spread among twenty centers. Most UPM centers are located in the urban district of Madrid, at the Madrid University Campus, although some of them of more recent creation are dispersed throughout the metropolitan area.

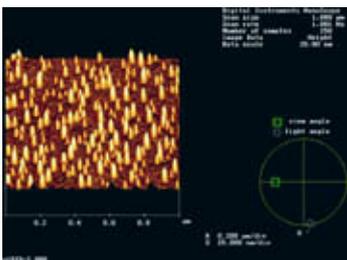


Tomato production greenhouse affected by collapse disease. The ethiology of this disease is being studied at the Department of Biotechnology of the UPM.

UPM offers 3 and 5/6 year degree-programs, covering all engineering areas and architecture. Graduate courses adapted to industrial needs are also offered which include both doctoral programs and postgraduate courses.

UPM graduates around 5,000 students every year, of whom 20% have participated in international mobility programs and have been trained in companies. There are around 2,000 students enrolled in doctoral programs, and each year 200 of these attain their Ph.D. degree. The UPM commitment to R&D and Innovation. Some results Each year, UPM receives over \$100 million in research support from external sources, out of a total budget of around \$375 million, an indicator of the scientific and technological capabilities of UPM.

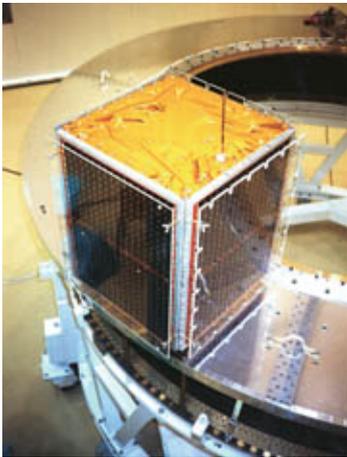
European Programs	\$12 million
National Programs	\$22 million
Regional Programs	\$12 million
R&D contracts with Industry	\$36 million
Testing and innovation	\$34 million
<b>TOTAL INCOME:</b>	<b>\$116 million</b>
R&D and innovation income distribution for 2003	



AFM picture of a quantum dot arraies for a new intermediate band solar cell (IES).

Participation in competitive European and national R&D programs provides 40% of sponsored research funds and research services and contracts with the industrial sector supply the rest. UPM ranks first amongst Spanish universities representing 15% of the total number of European funded projects, such as FP (Framework Program), EUREKA, ESA (European Space Agency), etc. Its participation in FP6 is strongly focused on the IST (Information and Society Technology) program which represents around half of the funded projects. UPM has implemented an entrepreneurship program to promote spin-off creation. Nineteen spin-offs have been created in 2002-2004. The contribution of the university to knowledge creation through its scientific publications is also significant. Most relevant is the high number of papers published in scientific journals and presented at congresses in 2003.

Journal papers	Conference papers	Ph.D. theses	Patents
1,123	2,003	198	15



50-kg class microsatellite UPM-Sat 1 developed at the Institute for Microgravity.



Platform for lateral stability for tankers at INSIA.

### **Current research activities at UPM**

Research at UPM is undertaken within several types of organizations: academic departments, institutes and centers. Most research is carried out associated to academic departments in research groups made up of faculty, postgraduate students, staff and technicians. Excellent research groups can be highlighted in several domains like materials science, biotechnology, telematics, software engineering, energy, robotics and industrial organization. These research groups have sophisticated equipment and experience in applied research and technology transfer.

Afterwards, UPM considers different modalities of ad hoc structures for its R&D and innovation activity, complementing department units; institutes, centers and laboratories, most of them known worldwide in their area, have state-of-the-art equipment and provide key technical support to national and international industry.

Some specialized R&D and technological innovation units are the following:

- Automobile Research Institute.
- Institute of Nuclear Fusion.
- Institute of Solar Energy.
- Institute for Systems based on Optoelectronics and Microtechnology (a national large-scale research facility).
- Institute for Microgravity.
- Institute of Biotechnology and Plant Genomics.
- Research Center for Transport.
- Center for Integral Domotics.
- Laser Center.

Three research institutes are highlighted to show some of the present capabilities:

### ***Institute of Solar Energy (IES)***

Founded in 1979, the IES has today some 50 scientists and technologists working in photovoltaic (PV) electricity conversion. Based on our early invention (1976) of the bifacial solar cells, able to convert the light falling on both its faces, IES spun off the company Isofotón, today the 7th biggest cell producer in the world. This situates Spain as the 4th world producer of solar cells, 80% for export.

An important research area developed at IES focuses on the development of concentration techniques for solar cells. In this field, the activities of the IES Measurements and System Integration Program must be highlighted for its contribution to the construction of the largest photovoltaic concentration plant in the world, of 480 KWp.

Mini-concentrators have also been developed at IES by the Optic Program for GaAs cells. The highest efficiency single junction cells in the world at 1,000 suns --26,2%-- have been manufactured in the III-V Technology Program in collaboration with the Ioffe Institute in St. Petersburg, headed by the Nobel Laureate Alferov. Metal Organic Chemical Vacuum Deposition equipment has been acquired to attempt obtaining multijunction solar cells with efficiencies of 30% and perhaps 40%.

### ***Institute for Microgravity***

Main space-related activities of the Institute for Microgravity are:

- USOC. User Support and Operations Center of International Space Station (ISS) for Spain. Facility Support Center of the ESA's Fluid Science Laboratory for Columbus (FSL).
- Microgravity. Study of liquid behavior under reduced gravity conditions. Experiments are performed both in orbital facilities and in ground facilities.
- Space technology. Design and manufacturing of payloads (CPLM for the Spanish Minisat-01, FUEGO, Osiris for the ESA Rosetta mission, Sunrise). Spacecraft thermal control (compilers of ESA handbook for thermal control).
- Satellite development. Design, manufacturing and operation of the 50-kg class microsatellite UPMSat 1 (launched July 7, 1995).

### ***The Automobile Research Institute (INSIA)***

INSIA currently counts on about ninety scientists and engineers. The scientific facilities, distributed into seven laboratories, are focused in the following R&D areas:

- Vehicle and traffic safety and "in-depth" accident research.
- Biomechanics. Occupants and opponents protection.
- Intelligent systems in vehicles.
- Engineering of buses and special transport vehicles.
- R&D on acoustics, measurements and instrument calibration.

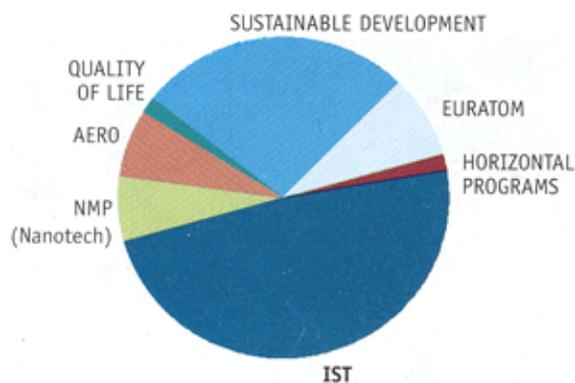
- Transportation studies.

The Institute has strong relationships with the automotive industry, including technical assistance, standardization and component testing. INSIA plays an active role in the main national and European R&D programs. It also offers specialized training and educational programs for professionals, including the Master's in Automotive Engineering.

### "Parque UPM"

UPM also recognizes the necessity of increasing the links with business and society for which the scientific and technological park --named "Parque UPM"-- was launched in 2000.

The "Parque UPM" has been designed for covering various high-tech areas, in four different sites, all in the metropolitan area of Madrid. Research institutes, business incubators, laboratories and so on are being established in the "Parque UPM" with a vision to build up a framework of reference in science and technology for the interaction of the academy and industry.



Participation of UPM across the FP6.

UPM web site: [www.upm.es](http://www.upm.es)

Phone: +34 913366047

E-mail: [secretaria.vinvestigacion@upm.es](mailto:secretaria.vinvestigacion@upm.es)

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# MADRID: Technology Capital, Open for Business



## Applying today's technology to the challenges of tomorrow



Pedro González-Trevijano,  
Rector of the URJC.



Large equipment and shared facilities are hosted in the Technological Support Center.

Founded in 1996, Rey Juan Carlos University (URJC) is Madrid's youngest public university. Despite its youth, it already combines a key role in higher education with thriving research activity. With talented young staff and an infrastructure custom-built for the 21st century, the university now boasts 17,000 students and a research income that has increased tenfold in the past five years.

The URJC was created to promote the cultural, economic and social development of south western Madrid. The four campuses are located in Móstoles, Alcorcón, Fuenlabrada and Vicálvaro, communities with more than 600,000 inhabitants among them. The corresponding campuses are centers of expertise in Experimental Sciences and Technology, Health Sciences, Communication and Tourism Sciences, and Law and Social Sciences.

### Supporting innovation

The URJC's links with industry range from the development of new technologies for industry to more than 2,500 students that carry out practical work at companies every year as part of their university training.



Modern labs and other facilities are provided for research.

At the School of Experimental Sciences and Technology, semi-industrial scale facilities for chemical engineering, environmental technology and materials science have been developed to provide innovative technological assistance to projects linked with the industrial sector. Several research projects are under development in partnership with the petrochemical company Repsol-YPF, whose Technological Center is the first occupant of a new technology park alongside the Móstoles campus. The materials science and engineering is directed to support innovation in reinforced and corrosion-resistant materials for the aeronautical, automobile and space industries. The DMR Consulting Foundation sponsors a multidisciplinary project aimed at promoting and developing decision-making methods and tools for Small-Medium Enterprises.

Research at the Law and Social Science campus views the academia-enterprise interface from the business perspective. An initiative in conjunction with Iberdrola, one of Spain's main energy-providers, aims at promoting the enterprise spirit in the academic sector, through the efficient transfer of knowledge to industry. A major research effort is being applied to the development of a monitoring center for the economy of Madrid, where the effects of innovation and sustainable development will be tracked and compared with the national and global markets.

### Environment

One of the primary goals at the URJC is the development of new and improved techniques to monitor and ameliorate human effects on nature. Several groups at the School of Experimental Sciences and Technology undertake research in a broad range of important environmental issues, from pollution control through conservation science to sustainable development.



The Libraries have been a major priority in the design of the campuses.

Research in environmental technology encompasses the design of new catalysts and adsorbent materials for environmentally-friendly processes, treatment and recycling of waste plastics, new treatments to remove contaminants from effluents, the future role of hydrogen as a green energy source and non-contaminant treatments for alloys.

The biodiversity and conservation research focuses on the effects of habitat loss and climate change on biodiversity, with case studies ranging from lichens and algae to butterflies and badgers. The geological researchers applies remote sensing, mineralogical and geochemical techniques to monitor toxic elements in the environment, and for analysis of the risks posed

by volcanoes and earthquakes. Research in the field of Physics concerns complex dynamics, instabilities, chaos and pattern formation in nonlinear dynamical systems, involving numerical simulations, theoretical analysis and laboratory experiments. Applied Mathematics research is devoted to the analysis of medical images, finite-difference and finite-volume methods for nonlinear ultrasonic waves, cryptography or algebraic methods for computing.

### **Health Sciences**

The primary research in this field is carried out at the School of Health Sciences, in conjunction with the hospital of Alcorcón. Faced with the challenges of an aging society, this campus conducts key research in oncology, cardiovascular illness, diabetes and dementia, with expertise in genomics and molecular biology. In addition, important pharmacological research into the treatment of pain and drug dependency is conducted in partnership with researchers from Spain's National Research Council (CSIC).

At the School of Experimental Sciences and Technology, the computer science department operates a state-of-the-art center for medical image analysis and its technological health support team is developing virtual reality systems to train surgeons for high risk operations.

### **Communication Technologies**

Staff at the School of Experimental Science and Technology play a key role in the development of communication technologies. The European Science Foundation supports an interesting project on the use of rational decision-making methods based on the Internet. Experts in artificial intelligence are participating in the European Network of Excellence for agent-based computing, where the use of multi-agent systems is applied for e-commerce, information retrieval and traffic management. Relevant projects are being funded by the European Union into the development of *Open Source Software*, especially for educational tools.

The Communication and Tourism Sciences School promotes expertise in the broadcast media with the use of truly state-of-the-art technical facilities. The audio-visual media laboratories include a LAN-networked set of digital editing suites comparable to the facilities of leading television stations. In addition, there is a custom-built laboratory for the development of wireless technologies for mobile broad-band communications.

### **Society**

Across the URJC, important research is conducted into the novel and complex challenges posed for society by globalization, demographic change and scientific and technological development. The Schools of Health Sciences and Communication Tourism Sciences examine the implications of large-scale human migration, whose legal, economic and political consequences are addressed by research at the Law and Social Sciences School. In partnership with the Regional Government Administration of Madrid and several national and international organisations, the Law and Social Sciences School has now opened the Unit for the Documentation and Analysis of Terrorism. This pioneer center is unique in Spain, and will play an important role in the analysis of causes, consequences and prevention of terrorism.

### **Facing the future**

Still at the beginning of a long journey, the URJC is a forward-thinking institution, tailor-made to face the challenges of the future, confident in its ability to take its place among the most prestigious research and technological institutions in Europe.



The Rectorate of the University is located on the Móstoles Campus.

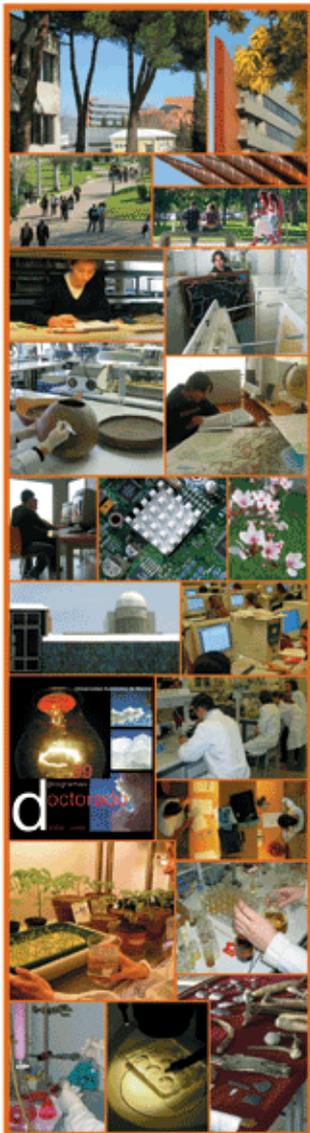
# MADRID: Technology Capital, Open for Business



## A scientifically and socially enterprising, prestigious and different university



Ángel Gabilondo Pujol,  
Rector of the UAM



Universidad Autónoma de Madrid.

The **Universidad Autónoma de Madrid (UAM)** is a state university offering graduate and postgraduate degrees in many different fields. It is a young university -- founded only 35 years ago -- but has already achieved an outstanding international reputation for its high-quality teaching and research. It is generally recognized as one of the best Spanish universities in both national and international rankings. The UAM is a modern and democratic institution in which decisions are taken with the participation of all the members of the community, and which is characterized by its strong social commitment and participation in society.

Most of the faculties and specialized institutes of the UAM are on the attractive Cantoblanco campus to the north of Madrid, easily accessible by train -- the station is on-campus -- bus and car. The Faculty of Medicine is near the Hospital "La Paz" and several schools of nursing belonging to the UAM are in different hospitals in Madrid.

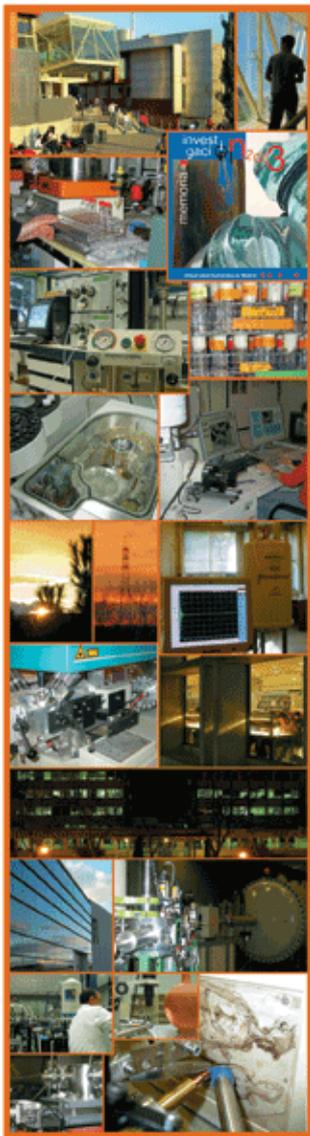
The UAM is very aware of its mission -- providing high-quality education to its students -- which means that its objectives are not restricted to the academic curricula, but include preparing the students both professionally and as democratic citizens. The university offers, then, an integrated approach to education, combining teaching and research and encouraging the participation of its students and researchers. To make this possible, the faculties and schools have many well-equipped lecture rooms, modern libraries, laboratories, etc.

The UAM has seven faculties (science, economics and business studies, law, arts, medicine, psychology, education) and an Engineering School for Computer Science and Telecommunications, offering a wide range of programs in different scientific and technical fields and in the humanities. The UAM offers 48 undergraduate degrees and 174 postgraduate or master's courses. Doctoral degrees can be studied for in all the areas mentioned above. The UAM is proud to announce that during this academic year, 25 of its Ph. D. programs in science, economics and business studies, law, arts, medicine, computer & electrical engineering and psychology have received recognition of their quality in the Education Ministry's annual evaluation of these programs for their excellence in teaching and research. For further information: [www.uam.es/estudios/doctorado](http://www.uam.es/estudios/doctorado)

The UAM has a well-established tradition in the area of cooperation, both national and international. It is one of the Spanish universities with the highest rates of student participation in international programs. During this academic year, for example, 757 students of the UAM are pursuing study programs in other universities and educational institutions, while 1,148 students from other universities and educational institutions are studying with us at the UAM. All these exchanges take place in the framework of about 170 bilateral agreements for cooperation with universities outside Europe and 319 Erasmus bilateral agreements for cooperation with European institutions.

### A Research-Oriented University

The UAM is a university with a distinguished record in research. Since its foundation, the development and support of high-quality research has been a very special goal of the UAM, and this has been rewarded by national and international recognition. The UAM has ranked among the top universities for its levels of excellence both in national and international measurements. These results have been achieved thanks to its highly-valued research teams and research institutes, as well to the existence of specialized experimental equipment and infrastructure. The research activity of the UAM covers a wide range of disciplines, from social and educational sciences and humanities to the basic sciences (physics, chemistry, biology and mathematics), health sciences and engineering. More than 2,000 professors and lecturers actively engaged in original research are organized in 60 departments, 8 research institutes and 20 additional centers for specialized studies and research. The research institutes are, in their respective fields, a point of reference and, again, cover many areas,



<http://www.uam.es>

from the humanities and social sciences (gender studies, local administration, education sciences, business administration, economic prediction, etc.) to basic and applied science (molecular biology, material sciences, biomedical research and others). High-quality clinical research is carried out in different hospitals belonging to the UAM. The university is proud of its collaboration with the Spanish Research Council (CSIC) with which it has created joint research institutes like the Center for Molecular Biology "Severo Ochoa", the Institute for Biomedical Research "Alberto Sols" and the Institute for Theoretical Physics, as well as of its cooperation with UNICEF/UNESCO in our Institute for Studies of the Needs and Rights of Children and Young People.

Besides the research laboratories with their technologically advanced instruments, research in the UAM is also supported by the Interdepartmental Research Service (SIDI). This service includes experienced scientists and highly qualified technicians, as well as world-class instruments, technologies and laboratories, to help experimental research in a wide range of areas. These facilities are also open to scientists and engineers from other institutions and to the R&D units of private companies. Very recently, technological platforms dedicated to genomics, proteomics and bioinformatics, equipped with state-of-the-art scientific instruments, have been created in the Science Park of Madrid, on-campus.

In September 2002, the UAM opened the Center for Micro-Analysis of Materials (CMAM), mainly dedicated to ion beam analysis applications, including radiation damage experiments. The laboratory is equipped with a new 5 MV electrostatic tandem accelerator and seven different beamlines specialized in different techniques for different applications (e.g. archaeometry, environmental studies, multipurpose nuclear physics, high resolution measurements, surface physics). An implantation and radiation damage line is being designed at present. The CMAM has already created a wide network of collaborations, including research programs and projects with groups from other universities, museums and different public and private institutions at the national and international level.

The significance of research carried out in the UAM can also be seen in the number and quality of the theses, research projects funded by national and international agencies and companies, scientific publications and in the international recognition of its researchers. The UAM has always felt that research is only valuable if it is internationally competitive and has social impact. For further information: [www.uam.es/memoriainvestigacion/html](http://www.uam.es/memoriainvestigacion/html)

Innovation is another important aim of the UAM. Through the Office for Transfer of Results of Research and Technology (OTRI) and the Science Park of Madrid, the UAM promotes the transfer of technology and results of research undertaken in the university, bringing our results and research abilities closer to society and the economy. In addition, there are activities to promote and support the knowledge-intensive and technology-based companies created by researchers at the UAM.

#### Some Key Figures (2003)

Students at Undergraduate Level: **29,353**

Students at Master's Level: **3,223**

Students at Doctoral Level: **3,576**

Academic and Research Staff: **2,276**

Administrative Staff: **892**

8 Faculties and Schools: Sciences (Biology, Mathematics, Physics, Chemistry, Environmental Studies), Psychology, Medicine, Law, Arts (Philosophy, History and Geography, Languages -- including Chinese and Japanese Studies), Economics and Business Studies, Education, Computer Science and Engineering.

Undergraduate programs: **48**; Postgraduate, Master's and Ph.D. programs: **174**

Theses defended in 2003: **424**

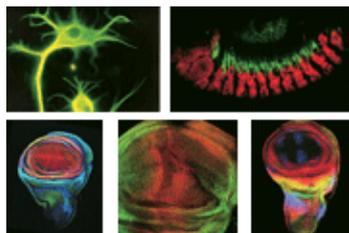
For further information:

<http://www.uam.es/presentacion/datos/uamencifras.html>

# MADRID: Technology Capital, Open for Business



[Centro De Biología Molecular Severo Ochoa](http://www.cbm.uam.es)

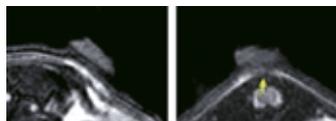


**Centro de Biología Molecular "Severo Ochoa"** is one of the largest and more important Spanish research facilities dedicated to molecular biology. It comprises 65 established research groups, mostly dedicated to basic research, although applied science projects are growing in number and resources. Scientific activity in the CBMSO is focused on five basic areas: I) **Developmental biology**, II) **Immunology and virology**, III) **Regulation of gene expression**, IV) **Neurobiology** and V) **Cell biology**. Scientific production results in about 180 peer-reviewed publications, and 25-30 Ph.D. degrees yearly. Currently, the CBMSO is undertaking the construction of a new building with substantially increased space, with the aim of creating a new scientific structure which will incorporate new, high-quality groups.

CBM, Facultad de Ciencias - UAM, 28049 Madrid-Spain

E-mail: [director@cbm.uam.es](mailto:director@cbm.uam.es)

Web: <http://www.cbm.uam.es>



Microscopic MRI of benign and invasive (arrow) papilloma.



[Institute Of Biomedical Research Alberto Sols IIB](http://www.iib.uam.es)



The **Institute of Biomedical Research "Alberto Sols" IIB** is a leading center of biomedical research and development in Spain. IIB seeks an integral understanding of disease and its treatment as the combination of molecular, cellular, physiological and pharmacological aspects. The Institute operates 73 independent research groups in the areas of cancer research, molecular endocrinology, cell signaling, enzymology and molecular pathology, regulation of gene expression, biochemistry and genetics of yeast and biomolecular structure and function. Strong industrial collaborations exist with national and international pharmaceutical companies, such as Justesa Imagen, S.A. A representative example of current research is illustrated: microscopic MRI shows the process of skin cancer invasion from benign (left) to invasive lesion (right, yellow arrow) as detected by the disruption of subcutaneous fat (H. Peinado, A. Cano, J. Medina, P. López and S. Cerdán, unpublished observations).

Web: <http://www.iib.uam.es>



[Parque Científico de Madrid](http://www.parquecientifico.com)

World-class scientific infrastructures and high-tech business development services



PCM, Madrid Science Park, was established as a non-profit foundation in 2001 by the Autónoma and Complutense universities of Madrid as its founding members, with the support of the Madrid Regional Government, to bridge the gap between the scientific and the business communities in our region and to contribute to its technological and economic growth.

Later, other research institutions have joined PCM's Board of Trustees: CSIC (National Scientific Research Council) and CIEMAT (Energy, Environment and Technology Research Center). Also private Banking Group Santander and the Madrid Chamber of Commerce are trustees.

At this time, PCM offers world-class scientific research infrastructures and technological business development services in the areas of biotechnology, biomedicine, information and telecom technologies, knowledge management, materials science and nanotechnology. Its main platforms include:

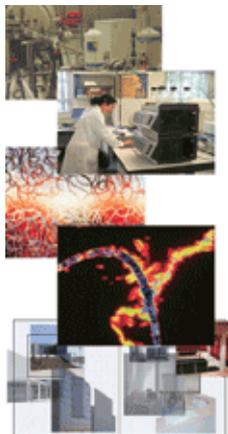
#### **Scientific Research Services**

- Materials and Surface Microanalysis (UAM 5Mev Linear Ion Accelerator)
- Genomics Research Unit (DNA Sec, real time PCR, DNA Micro arraying)
- Proteomics Research Unit (MALDI-TOF-TOF, HPLC-Q-TOF, Ion Trap)
- Bio-computing and LIMS Network
- Animal Microbiology and Food Safety Center (UCM)
- Nanotechnology Research Networking (Phantoms Network)

#### **Business Development Services**

- Scientist-Entrepreneur Support Center
- Spin-off Development
- Innovation and Technology Watch (CIAA)
- Knowledge Society Research Center (CIC)
- Small Business Incubator (160 square meters, on-campus)
- Industrial Business Incubator (2,400 square meters, off-campus)

PCM, Pabellón C - UAM, C/ Einstein, 13. 28049 Madrid, + (34) 91 4972400, <http://www.pcm.uam.es>





**The Universidad Nacional de Educación a Distancia (UNED)**

## Fully Open Teaching System



**Araceli Maciá, Rector of the UNED.**



UNED students during lab practice at an associated center.



A student attends a tutorial at the Associated Center of Segovia.



Image of the UNED Central Library.

The Universidad Nacional de Educación a Distancia (UNED) is the main Spanish university providing high level education for students throughout the complete Spanish territory. UNED is organized in two levels: the headquarters, located in Madrid, and the associate centers, spread nationwide. Founded in 1972, UNED has grown at present to about 1,200 faculty members, teaching in the Headquarters with the help of about 1,100 staff technical assistants. The Fully Open Teaching System, exclusive at UNED, is made possible with the help of about 5,000 tutors based in the 60 Associate Centers through the country and some others Collaborative Centers located in foreign countries.

UNED is a student-centered university with over 150,000 undergraduate students engaged in the different academic programs of the Schools of Arts and Sciences and Engineering. The academic staff is organized into specialized departments. As an example, the School of Sciences, with more than 4,000 students is divided in four sections, corresponding to chemistry, environment, mathematics and physics respectively.

The characteristic open transmission of knowledge consist mainly in the use of original text books, named "Unidades Didáticas" and workbooks, written in both cases by specialized teaching staff. Additionally, these unique teaching programs are complemented with supplementary information available on line and through the Internet at [www.uned.es](http://www.uned.es).

UNED, however, is not only a university dedicated to undergraduate students. Its academic staff implements very active research programs, where graduate students are able to develop adequate Ph.D. programs in the various fields of knowledge. Some of the well-established UNED research groups decided in 2001 to join their efforts and create the University Research Institute (Instituto Universitario de Investigación UNED). So far, these research groups -- with strong, external and competitive financial support -- are grouped in 11 centers and four sections of different research areas. The structure of the Institute is open to all the members of UNED and to other public and private research institutions wishing to contribute to this important UNED initiative. Some illustrative examples of the main research lines follow:

Compared Social Structures is devoted to the empirical analysis of social sciences based on the application of novel statistical approaches. These methodologies seek to describe, explain and simulate social dynamics.

Studies of Aging and Neurodegenerative Diseases develops studies on the implicit and explicit memory in normal aging and Alzheimer's diseases, providing new clues to early diagnosis and treatment.

Advanced Chemical Technologies provides high-quality research and development in methods of organic synthesis and chemical engineering. Its main activities involve the preparation of new pure optically active molecules, advanced research in the chemistry of surfaces and novel approaches to diagnosis by biomedical magnetic resonance methods.

In summary, the main goal of UNED is to excel in the production of new knowledge, in the training of new generations and in the transfer of results to society.

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# MADRID: Technology Capital, Open for Business



Laureate International Universities  
[Universidad Europea de Madrid](#)

## Your world can be the whole world

**LAUREATE**  
INTERNATIONAL UNIVERSITIES

### Europe

École Centrale D'Electronique  
École Supérieure du Commerce  
Extérieur  
K.I.T. eLearning  
Glion Institute of Higher Education  
IEDE, Institute for Executive  
Development  
Les Roches Hotel Management  
School  
Universidad Europea de Madrid

### North America

Walden University  
National Technological University  
Canter & Associates

### Central America

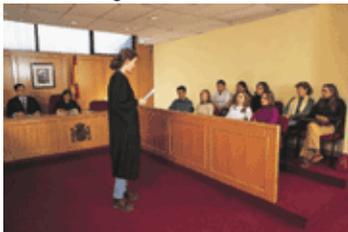
Universidad del Valle de Mexico  
Universidad Interamericana de Costa  
Rica  
Universidad Interamericana de  
Panama

### South America

Academia de Idiomas y Estudios  
Profesionales  
Universidad de las Americas, Chile  
Universidad de las Americas, Ecuador  
Universidad Nacional Andrés Bello  
Universidad Peruana de Ciencias  
Aplicadas

### Asia

Les Roches Jin Jiang International  
Hotel Management School



Students learning with close replica  
labs of profesional environment.



View of the UEM Campus in Villaviciosa de Odón.

International exposure, projection and permanent dialogue with the working world, learning by practice, training professional skills and the introduction of new technologies constitute the main guidelines of the Universidad Europea de Madrid, an institution backed by over 15 years of experience within university education. Nowadays, the Universidad Europea de Madrid has over 7,900 students, offers 29 university degrees and 9 official "double degrees", 60 postgraduate courses and doctorate degrees in organization with 6 Schools (health sciences, architecture and arts, polytechnic, business and law, communication and sports).

### International

UEM is member of Laureate International Universities, the world's largest network of private, post-secondary educational institutions.

Laureate International Universities' network currently includes 17 campus-based and online institutions in Europe, Latin America, North America and Asia serving more than 150,000 students worldwide. Each institution brings to the network an established reputation for educational and academic excellence, a sensitivity to local culture and tradition and a dedication to delivering the highest-quality, internationally-minded education experience.

Universidad Europea de Madrid campi are an international exposure with students and teachers from different nationalities and promote and encourage activities with an



Learning by practice.



Sports complex of more than 14,000 square meters.



Students attending real patients in the Policlinic Campus.



UEM was the first wireless campus in Europe.

international vision. UEM offer through the network the exclusive GARCILASO and Study Abroad Programs.

Besides this, UEM has more than 200 agreements with European universities, and ERASMUS or SOCRATES programs.

### **Learning by practice**

Professional training builds an important part of the first years at the university. All labs and facilities are a close replica of the professional environment that the student will encounter when already working.

The students can further their experiences by working in the university's facilities and "clinics" or in one of the 900 leader companies with which the university has agreements.

### **Training professional skills**

Theory and practical knowledge has to be complemented with the training of professional skills which are requested by the working world.

Universidad Europea de Madrid has developed a program to foment the students abilities in such areas as communication skills, team work, initiative, leadership, self-esteem,...

UEM students are also trained in cultures and values issues.

### **Technology**

New technologies are a main feature at the Universidad Europea de Madrid. It is in fact the first Spanish university to offer a wireless campus, that enables all students to access Internet from any point on campus with their wireless laptops.

### **Campus**

Universidad Europea de Madrid develops its activities at three different campuses in Madrid:

Villaviciosa de Odon: 25 hectare campus fully equipped with the most advanced technology in labs. A sport complex of 14,000 square meters, and two dorms with more than 550 beds are also included in the campus.

Chamartin: located in the center of Madrid, giving services to the executive and postgraduate programs.

Policlinic: has become the health sciences training center where students apply theoretical concepts and attend real patients in the their learning process, also in the center of Madrid.

### **Quality certifications**

Universidad Europea de Madrid has been the first Spanish university to receive Quality Services Certification and the Madrid Excelente seal for quality from the Comunidad de Madrid.



[Centro de Investigaciones](#)

[Energéticas, Medioambientales y Tecnológicas](#)

## Focusing R&D on energy and the environment



View of the CIEMAT Moncloa Center.

CIEMAT (Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas) is a research center whose activities started at the beginning of the Fifties. At that time, its name was "Junta de Energía Nuclear (JEN)" and it was mainly focused on nuclear energy, but in the Eighties it became a multidisciplinary institute. Currently the main fields of research are, besides nuclear energy, other energy sources, the environmental impact of energy and the development of associated technologies for social applications, in addition to basic research in particle physics and molecular biology.

To fulfil these purposes, CIEMAT employs some 700 researchers and engineers, and around 500 people in auxiliary and administrative tasks. The Moncloa Center, in Madrid, is the main site of CIEMAT, but there are two more in Spain: CEDER (Centro para el Desarrollo de Energías Renovables) in Soria, and the Solar Platform in Almería (PSA).

The annual budget is about € 85 million, plus external financing for projects and services to industry. In addition to this, CIEMAT has also the legal property of 80% of ENRESA (Empresa Nacional de Residuos) and 40% of ENUSA (Empresa Nacional del Uranio). The tasks of these two companies are, respectively, the disposal of radioactive wastes and the fabrication of fuel elements for NPP.

In the field of fission, CIEMAT is the technical support officer for Spanish industry in areas such as nuclear materials, severe accidents, fuel elements, man-machine interface, transmutation of actinides, GIV in Nuclear Power Plants, etc. The collaboration with Europe, specially through EURATOM, NEA (OECD), and IAEA, is of utmost importance.

Concerning solar energy, the research program is based on the Solar Platform, the largest European solar research installation. In the plant, different technologies -- such as the Central Receptor System, Cylinder-Parabolic Collectors, and solar chemistry -- are being developed. In the photovoltaic sector, there are groups that are working on thin layers of different materials for photovoltaic cells. Solar energy optimisation in buildings is also becoming an increasing activity at CIEMAT.

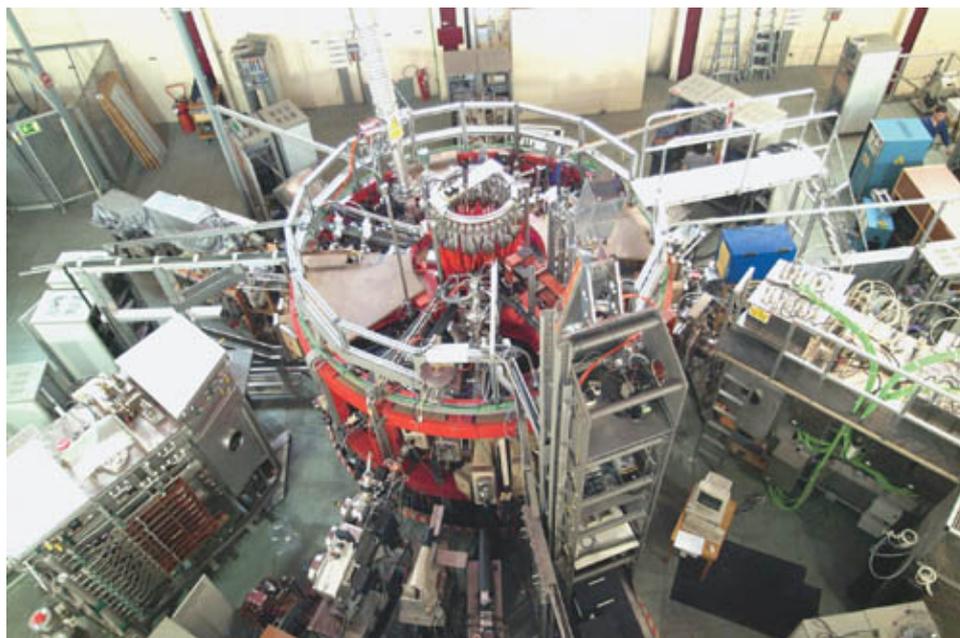
In the domain of the energy use of biomass, lines of work related to the production of bioethanol are being developed. Some of these activities, as well as the clean use of fossil fuels, are being carried out in the installations of CEDER (Soria).

The eolic component of electricity is becoming an aspect of paramount importance in Spain, and CIEMAT contributed to its deployment as a mature industrial sector. At present, the emphasis is put on the development of small facilities for isolated sites and hybrids.

In the field of nuclear fusion, all our activities are framed within the EU magnetic confinement fusion program; specifically, the TJ-II facility is a stellerator of heliac type currently in operation. In addition, CIEMAT is collaborating with JET and the ITER project.

The evaluation of the impact on the environment of different forms of energy is, at present, an essential component of all the CIEMAT activities. Procedures to evaluate, control and reduce this impact are elements of these activities. Radiological protection, dosimetry, hydro geochemistry characterization, and materials in deep geological storage of radioactive wastes are other components of this area. Atmospheric pollution is another subject, mainly in the field of simulation and modelling, together with pollution and mitigation of polluted soils.

In the elementary particles area, CIEMAT was the first research center in Spain to participate in the experimental program of CERN, and played an important role in its definitive incorporation as a member state. At present, it maintains a tight collaboration with CERN in the framework of the LHC project, and participates in other experiments, in particular related to the International Space Station.



View of the CIEMAT TJ-II.

Last but not least, the studies on molecular biology, and cellular and gentherapy, with special mention of the project on ephithelial damage, repair and engineering.

The Center is also active in several technologically advanced fields such as precision mechanics, materials, electronics, robotics, information technologies and analytical chemistry.

In addition, CIEMAT is establishing new centers according to the interest of the Spanish Autonomous Communities in the domains of its competences.

Currently, CIEMAT's vocation is to participate in large projects at European or world scale, and the Center gives particular relevance to collaborate, inside the European framework, with the US, Latin American and Mediterranean countries.



View of the CIEMAT Solar Plant of Almería.  
In the corner, a view of CEDER (in Soria).

# MADRID: Technology Capital, Open for Business



Centro Nacional de Investigaciones Oncológicas (CNIO)

Centro Nacional de Investigaciones Oncológicas (CNIO). Spanish National Cancer Center  
Bridging basic and translational research - a coined phrase, a CNIO reality



A Royal Endorsement: His Majesty King Juan Carlos I congratulates Mariano Barbacid upon his return to Spain to lead and direct the CNIO project.



The CNIO building.



Latest diagnostic technologies.



Cutting-edge robotics and technology.

"...the National Center for Cancer Research, or CNIO... has in just six years gained an international reputation that most of Spain's universities and institutes can only dream of. Bureaucracy is minimal, and scientists can be recruited at any time." (Editorial: "Ending the Pain in Spain", Nature, 428, 4 March 2004).

The year 1998 witnessed two essential developments for cancer research in Spain: the idea of setting up Spain's first-ever cancer research center on a national level was conceived -- the Centro Nacional de Investigaciones Oncológicas (CNIO) -- and the return home of Mariano Barbacid who was hand-picked to pioneer and direct the entire project.

The CNIO opened its doors officially for business in February 2002 ("The real deal in Madrid", Nature, 416,472) and strives to address the gap existing between oncological research and translation to the clinic.

### Research at the CNIO

With a 50/50 basic and translational research approach, the CNIO is one of the few European Cancer Centers of excellence to fuse basic research with molecular diagnostics and, in the future, target-based drug discovery to translate scientific advancement into a reality for patients within the Spanish National Health System.

The CNIO enjoys a management system combining the stability provided by public financing with the flexibility associated with the private sector. This unusual mixture, at least for Spanish scientific centers, allows an open recruitment policy breaking away from age-old barriers. The CNIO has the adequate space and outstanding facilities necessary to recruit a staff of up to 500 scientists.

### CNIO Location and Building

Our Center is based in the north of Madrid -- a modern, cosmopolitan city famous for its inviting atmosphere -- and is conveniently situated close by to major hospitals, universities and an expanding biotechnology industry.

The CNIO has a total surface area of 32,000 square meters of which more than 10,000 is dedicated to laboratory space and 3,000 to one of the largest SPF Animal Facilities in

Europe, with a capacity of housing 80,000 mice. This excellent core facility is allowing us to develop state-of-the-art animal tumor models using the latest gene targeting technologies.

Another asset of the CNIO building is its Auditorium which hosts the annual series of CNIO Cancer Conferences ([www.cnio.es/cc](http://www.cnio.es/cc)), attracting renowned figures in the cancer field worldwide. This facility also houses our CNIO symposia, meetings, seminars, courses, and lectures.

### **Research Programs**

Our main and rapidly expanding research programs currently incorporate an international and young scientific group of over 270 individuals:

#### **Molecular Oncology**

Directed by M. Blasco, this program studies the molecular mechanisms associated with the cancer cell: cell cycle, tumor suppression, telomeres, DNA stability and signal transduction, to name but a few. Goals surround the study of basic aspects of cancer biology, with special emphasis on the development of new model organisms -- principally mice models. This program incorporates groups of international reference led by M. Barbacid, M. Serrano, Á. Nebreda and M. Malumbres, as well as junior groups led by young scientists trained in some of the best labs throughout Europe and the US.

#### **Structural Biology and Biocomputing**

Two X-ray Crystallography Labs led by G. Montoya and J. Bravo, and an NMR Resonance Group headed by F. Blanco, form the core of our program dedicated to structural biology. New groups on molecular modeling and biocomputing will soon be joining.

Aims include understanding biological function at the structural and mechanistic levels, to determine the structural basis of disease-related alterations in biological macromolecules and to aid the development of novel anti-tumor agents.

#### **Molecular Pathology**

Led by the internationally recognised expert in the molecular biology of lymphomas, M. A. Piris, this program represents molecular diagnostics of cancer and aims to explore the different genetic and epigenetic alterations in human cancer to allow a more accurate diagnosis based on the pathogenic characteristics of tumors. Groups focus principally on cancer epigenetics, lymphoma, lung cancer, breast and gynaecological cancer with an essential mix of renowned oncologists, hematologists, pathologists and basic researchers to contribute to a generalised use of postgenomic techniques with more clinically relevant objectives.

#### **Human Cancer Genetics**

Directed by J. Benítez, this program studies cancer from a genetic and cytogenetic point of view, with emphasis on the in-depth analysis of the genetic bases of familial cancer and the search for low penetrance and modifier genes that can confer susceptibility for developing cancer. This program also manages our Hereditary Cancer and Genetic Counseling Service. These efforts will be accelerated by the recent establishment of the National Genotyping Center (CeGen), at the CNIO, an initiative allowing high throughput genotyping of cancer patients.

#### **Biotechnology**

Directed by I. Casal, this program implements and improves the latest technological advances in biotechnology and biomedicine. Emphasis is placed upon technology transfer and the rapid transferral of all CNIO developed reagents and technologies for clinical diagnostic purposes, resulting in essential collaborations with other biotech entities and clinicians.

Cutting-edge technologies include those for cytogenetics (FISH, SKY, CGH assays), functional genomics (DNA chips/shRNA libraries), immunohistochemistry (micro arrays), monoclonal antibodies and generation of transgenic mice. Special support units include a strong bioinformatics group, a confocal microscopy and cytometry facility, and a comparative pathology unit.

#### **Spanish National Tumor Bank Network**

Coordinated by our Molecular Pathology Program, the Tumor Bank Network is Spain's first national network of tumor banks, and also the first of its kind to be operational within Europe. This pioneering initiative collaborates with clinical oncology departments at several Spanish hospitals, facilitating samples and exchanging resources and knowledge.

#### **Scientific Careers and International Partnerships**

Within the young and exciting CNIO environment springs new opportunity through initiatives such as our recent call for Junior Group Leaders to attract young and ambitious scientists

(foreign nationals are particularly encouraged to apply), who wish to join the CNIO to build and lead their own research teams, incorporated within our main programs for a five-year period. For example, the Molecular Oncology Program has already set up four new Junior Groups working on chromosome dynamics, DNA replication, DNA repair and cell competition.

Dedicated to training young researchers, we offer training programs of excellence for highly driven individuals such as graduate students and postdoctoral fellows, and provide molecular pathology training for talented undergraduate university students.

#### **Towards the future**

Our ultimate challenge will be to establish a 50+ people program focused on target-based drug discovery combining existing expertise in cell-based assays, structural biology, in silico screening and gene targeted-based animal tumor models incorporating essential sophisticated medicinal chemistry, yet to be introduced.

People and the collaborators at the CNIO both shape and secure our future. We want to hear from all research, healthcare and industry professionals who share a keen interest in joining us to make the difference in combating cancer.

Growth and development at the CNIO has been made possible thanks to support from the Spanish Ministry of Health and our sponsors (for current sponsor list please consult our 2003 Scientific Report on our website: [www.cnio.es](http://www.cnio.es)).

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[Council of Scientific Research \(CSIC\)](#)

## Council of Scientific Research: Spain's main R&D institution



Natural History Collections housed at CSIC.



Researcher from the CSIC examining pellets.



Research on waste water treatment.



A view of the Royal Botanic Garden of Madrid.

The Spanish Council for Scientific Research (CSIC in its Spanish abbreviation), is the country's main body for basic research: it represents by itself 20% of the scientific output of the country, or 0.55% of the world's scientific publications. It is perhaps astonishing that CSIC is also the first applicant from Spain to the Patent Cooperation Treaty. With its 62 applications in 2003, it ranks indeed above not only all the country's universities, but all the industrial companies too.

CSIC has 125 institutes installed all over Spain, both in the mainland and the islands, and almost half of them are located in Madrid, where the central headquarters are also situated. Besides libraries and laboratories, CSIC owns museums, oceanographic vessels, natural parks and reserves, experimental farms, astronomical observatories and it administers one of the Spanish Antarctic bases and the polar ship B/O Hespérides.

More than 12,000 people work in the CSIC, from tenured scientists, to technicians, administrative staff and research fellows. About 2,000 doctoral students are carrying out their theses in CSIC's different institutes.

CSIC was founded in 1939, immediately after the Spanish Civil War, but it was built upon the remains of La Junta para Ampliación de Estudios (The Board for the Advancement of Studies), established in 1907 and whose first president had been the Nobel Prize winner Santiago Ramón y Cajal. Professor Severo Ochoa, who received the Nobel Prize in Medicine in 1959, worked in the laboratories of the Junta before the Civil War. Its well known "Residence of Students", where such scientific celebrities as Einstein or Mme. Curie were lodged, is one of Madrid liveliest cultural institutions.

CSIC is a member of the main scientific unions and learned societies of the world and it keeps regular exchanges with most research councils and R&D institutions of Europe, Latin America and OECD countries.

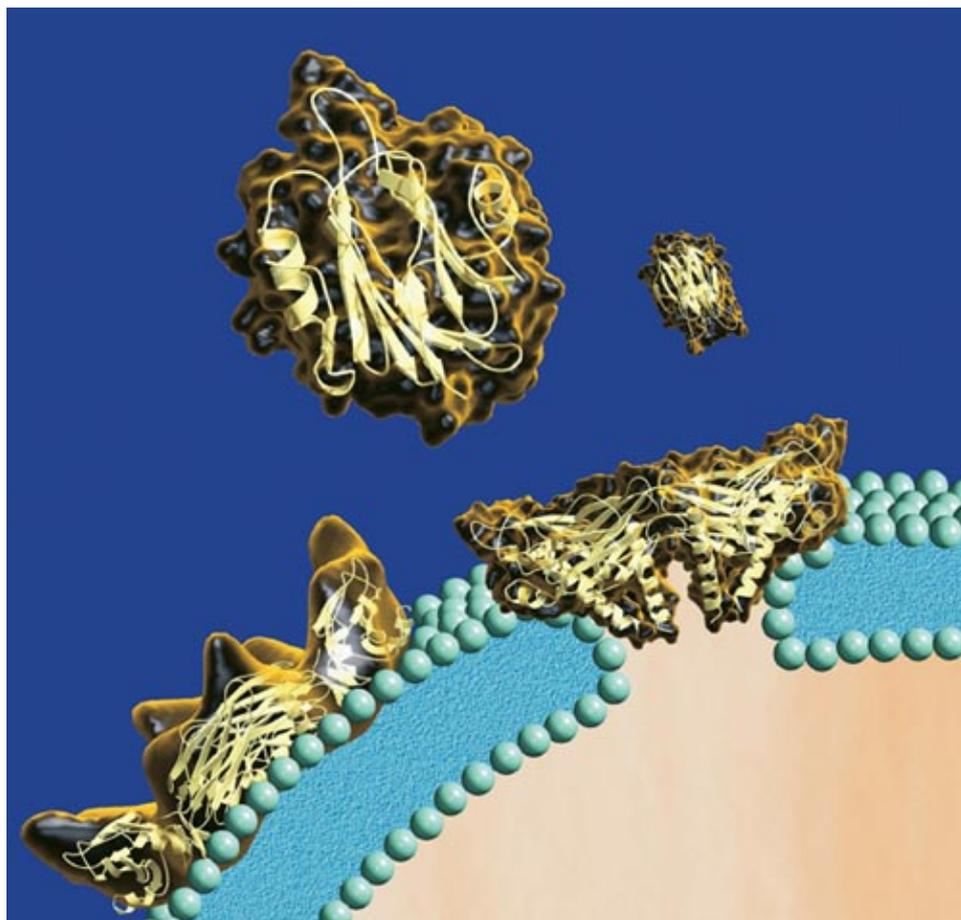
### Research Fields

As a multidisciplinary research organisation, the Spanish Council for Scientific Research covers virtually every field of knowledge. Its research activities are classified into eight areas:

- Agricultural Sciences
- Biology and Biomedicine
- Chemistry: Science and Technology
- Food Science and Technology
- Humanities and Social Sciences
- Materials: Science and Technology
- Natural Resources
- Physics: Science and Technology

### **Cooperation with industry and technology transfer**

The CSIC's R&D activities in conjunction with industry are promoted, fostered and managed by its Technology Transfer Office. CSIC researchers are attracting more and more financial resources through contracts with industry, as the CSIC has become the reference organisation for the transfer of technology in Spain. Approximately 600 contracts are concluded annually with Spanish industry for a total amount of over € 24 million.

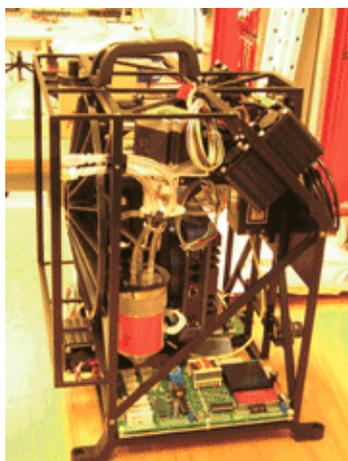


The determination of three-dimensional structures of molecules has produced crucial progress in science.



CENTRO DE ASTROBIOLOGÍA  
ASOCIADO AL NASA ASTROBIOLOGY INSTITUTE  
**Centro De Astrobiología**

## Searching for life in the universe



Prototype of an instrument for the detection of biomolecules in interplanetary exploration.



Center for Astrobiology (CSIC-INTA).

Does Life result from the evolution of the Universe? Did it arise on Earth by chance, or is it a frequent phenomenon? Is there life elsewhere than the Earth? What is the future of Life on Earth? Astrobiology attempts to answer these and related questions. A first step is to understand the basic rules underlying the process of life and its origin on our planet. Finding the answers to these questions, and helping answer the question "What is Life?" are the backbone of the Astrobiology Center Research Program which approaches them with the hypothesis that "life is a consequence of the evolution of the Universe."

The Center for Astrobiology (CAB) is a Joint CSIC-INTA Center [Spanish Council for Scientific Research - National Institute for Aerospace Technology] with the participation of the Madrid Local Authority (CAM). It is located on the INTA campus in Torrejón de Ardoz, Madrid.

It is an Associate Member of the NASA Astrobiology Institute (NAI), which combines fourteen groups of scientists and laboratories throughout the United States of America.

To maintain the ambitious search for a bridge between the Big Bang and Biology applying the scientific method, the CAB is structured as laboratories with highly interwoven research projects. A basic feature of the CAB is cross-fertilization between disciplines, which attempts to bypass the impossibility of reproducing the history of life on Earth. Robotic exploration is also under way, to study life at the extremes and develop technology and instruments for exploring other parts of the Universe in the search for signs of life.

The CAB building was inaugurated in 2003, and its 7,000 square meters house offices, the library, a 140-seat auditorium, nine laboratories, three support scientific units, and a greenhouse, as well as an array of half-meter robotic telescopes.

The CAB laboratories are:

1. Transdisciplinary Laboratory.
2. Advanced Computation, Simulation, and Telematics Laboratory.
3. Planetary Geology Laboratory.
4. Molecular Evolution Laboratory.
5. Microbial Evolution Laboratory.
6. Molecular Ecology Laboratory.
7. Extremophilia Laboratory.
8. Bioinformatics Laboratory.
9. Robotics and Planetary Exploration Laboratory.

Scientific topics at CAB include evolution, from molecules to viruses and bacteria, adaptation of life to planet-like environments in the solar system, development and operation of ecosystems and even the formulation and testing of mathematical theories of life.

Technology is also being generated to search for extraterrestrial life, new techniques are being invented for its recognition, and instruments for Mars missions are being designed. The NASA 2009 Mars mission will fly a CAB-led instrument.

A hundred people work at the CAB, ranging from physicists to engineers and including biologists, geologists, chemists, etc. Their publications appear in leading scientific journals, and their patents are available for licensing.

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# MADRID: Technology Capital, Open for Business



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ENGINEERS AND CONSTRUCTORS  
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**TECNICAS REUNIDAS**  
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**2,000 PROFESSIONALS**

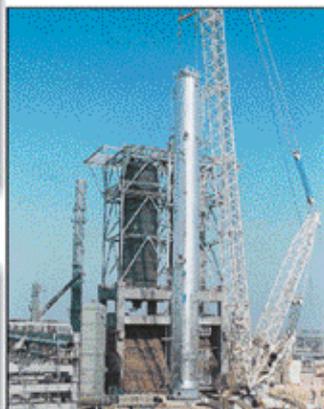


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Spanish Association of Aerospace Industries

[ATECMA \(Spanish Association of Aerospace Industries\)](#)

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## Aerospace Industry: A strategic sector for Madrid, technology capital

Spanish aerospace companies are leading technological development, and the greatest concentration of these is to be found in the Madrid Region, where their historical presence can be traced back over 75 years.

These companies cover the entire spectrum of the aeronautics industry: construction of aircraft and helicopters, aircraft and helicopter engines, on-board and ground-based aeronautical equipment, simulators, air traffic control systems, automatic test systems, aircraft and engine maintenance, etc.

These companies also represent the entire supply chain, from platform integrators to small suppliers of equipment, sub-assemblies and processes, from engineering companies to maintenance centres.

There are over 23,000 direct jobs in the aeronautics construction industry, though the number of Spanish workers involved in the sector in one way or another is close to 100,000.

These capacities enable the Spanish aeronautics industry to lead domestic aerospace programs, participate in the main international programs and make it a reference of excellence in the sector at world level.

In the area of composite materials, AIRBUS España is the world leader thanks to the design, development and manufacture of key elements such as horizontal stabilisers, and belly fairings and the introduction, for the first time in the history of commercial aviation, of carbon fiber fuselage sections for planes of over 100 seats. This is the result of the development of "Fiber Placement" processes that make it possible to manufacture highly-curved panels, and resin-transfer moulding.

EADS CASA is responsible for the military transport planes of EADS, the "FITS" tactical mission system and the military derivatives of the Airbus, including in-flight refueling. It is also part of the Eurofighter Consortium (European combat aircraft) and, within EADS, leads the future A400M high-capacity military transport plane, with responsibility for the final integration of these planes and systems.

GAMESA Aeronáutica is the leader in international markets in advanced technologies, and its activities cover all areas from the conceptual design right through to the trials, certification, production and after-sales service of large aeronautics structures and aircraft interior components, in both light alloys and composite materials.

ITP engages in the research, design, development, manufacture, assembly and trials of aeronautics engines and gas turbines with aeronautics applications. At present, it is making important technological advances, one example of which is the sole vector nozzle under development in Europe, and it is the supplier of low-pressure turbines to ROLLS ROYCE. ITP is involved in engine and gas turbine activities for American and European manufacturers.

INDRA is the leading company in complex electronic systems for aeronautics and defense in Spain. Due to its activities in simulation, ATM, communications and electronic equipment, among others, it is a major reference in the markets in which it operates, at both national and international level and is present in over 40 countries on all five continents.

CESA is supplier of landing gears and hydraulic and pneumatic systems for both military (A400M, Eurofighter, TIGER and C-295) and civil aircraft (A380, A340-600). Iberia

Maintenance and Engineering provides a unique and competitive position in the global marketplace. Not only providing full support to their own fleet but also to other Spanish Airlines and quite a lot of Airlines all over the world. Their facilities, located in Madrid, offer a full range of services applicable to modern aircraft and engines: from Boeing B757 to Airbus A320 and A340, from RB211 535E4 to CFM56-5x family.

Among their customers there are main lessors, leader Airlines like BA, B757 Operators from USA, China, SouthAmerica, Europe and Africa, Airbus Operators from America, Europe, Middle East and China and several MD-80's Operators. In addition to these lead companies, over 100 auxiliary companies provide support to the sector, and all of them, both lead and support companies, are represented in ATECMA (Spanish Association of Aerospace Industries), whose website ([www.atecma.org](http://www.atecma.org)) gives a great deal of information on the sector and access to the corporate websites of each company.

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# MADRID: Technology Capital, Open for Business



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## BUSINESS IN SPAIN

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## BUSINESS

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### JANUARY

- 13 | 17** **INTERNATIONAL GIFT, JEWELLERY AND FASHION JEWELLERY WEEK**  
INTERGIFT   
IBERJOYA   
BISUTEX
- 26 | 30** **FITUR**   
International Tourism Trade Fair

### FEBRUARY

- 10 | 13** **CASA PASARELA**  
Design Fair for Home Trends
- 10 | 14** **ARCO**  
International Contemporary Art Fair

- 11 | 14** **SI MM MADRID INTERNATIONAL FASHION WEEK**   
IMAGENMODA   
INTERMODA   
IBERPIEL PELETERÍA   
CIEN X CIEN
- 14 | 17** **CIBELES FASHION SHOW**
- 22 | 24** **TEXTILMODA**   
International Textile Fashion Fair
- 23 | 25** **GENERA**  
Energy and Environment International Trade Fair
- 23 | 26** **CLIMATIZACIÓN**   
International Air-Conditioning, Heating, Ventilation and Refrigeration Exhibition

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