

Research  
to improve



EXCELENCIA  
SEVERO  
OCHOA

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At the CNB, we work to unlock the secrets of living things and to apply our research results to the development of new, safer, more effective compounds and technologies that will allow us to improve our health, our agriculture and our environment.





In this brochure, we summarise our work at the National Centre for Biotechnology (*Centro Nacional de Biotecnología*, CNB), a research centre that belongs to the Spanish National Research Council (*Consejo Superior de Investigaciones Científicas*, CSIC), Spain's most important public scientific institution.

The CNB opened in 1992 to lead in developing modern biotechnology in Spain. Today, among thousands of research centres worldwide in the area of the life sciences, the CNB is among the top 50, and among the top five in Spain. In 2014, the CNB received the *Severo Ochoa* distinction as one of the seven Spanish flagship centres in the area of life sciences and medicine.

Our principal objectives are to:

- Acquire knowledge and develop new technologies in the areas of human and animal health, agriculture and the environment.
- Promote knowledge and technology transfer for the benefit of society.
- Train future generations of researchers and technologists.
- Engage and inform society about advances and benefits of biotechnology.

Modern science advances at a breathtaking pace and requires constant investment in new equipment and increasingly sophisticated scientific technologies, as well as in the training and recruitment of qualified experts.

We face this challenge with a team of more than 500 professionals committed to quality research. We hope these pages will awaken the reader's interest in our work and our results.

Welcome to the CNB!



# health

## Vaccines and antibiotics to combat **infection**

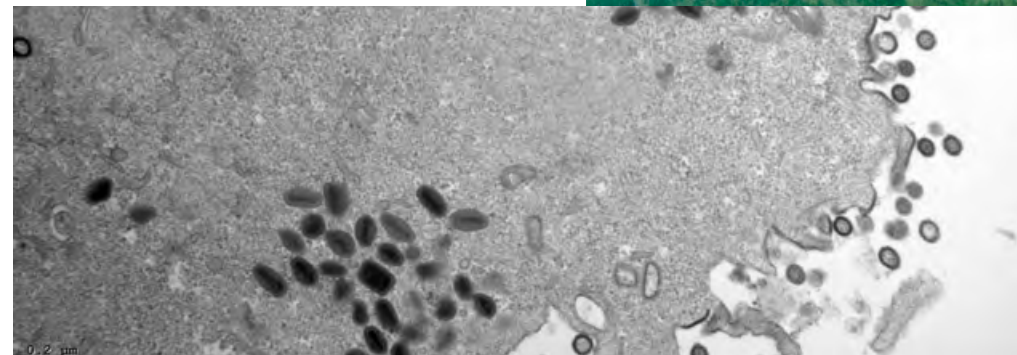
Infectious diseases remain a major threat to public health. At the CNB, we study many viruses and bacteria that cause infections. Our research contributes to **new vaccines** for serious infectious diseases including **AIDS, influenza and malaria**.

We also develop vaccines to prevent **contagious, economically devastating animal infections**, such as that produced by the porcine reproductive and respiratory syndrome virus.

To fight bacterial **infections that affect millions of people annually**, such as pneumonia or meningitis, we help to **discover new antibiotics** that have no harmful effects on the body and are effective against pathogenic bacteria that have become resistant to current antibiotics.



The AIDS pandemic affects tens of millions of people worldwide. Our scientists at the CNB are working on the development of a vaccine that holds the promise to control the type of AIDS virus most prevalent in Europe and America.



In collaboration with other research centres, hospitals and companies - and with financial support from the Bill & Melinda Gates Foundation - we have obtained a prototype vaccine that showed very promising results in clinical trials.

We collaborate with international organisations to eradicate epidemics and combat antibiotic resistance.







# health

## New **diagnostic and treatment** methods to win the battle against disease

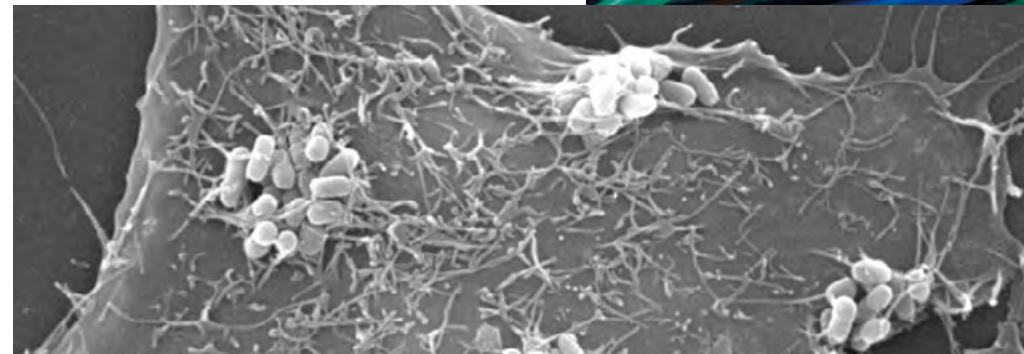
The aging of the world's population is associated with an increase in chronic inflammatory and neurodegenerative diseases, and a **greater incidence of cancer**.

We study cell malfunctions during aging, to design new methods for **early diagnosis of diseases** such as arthritis, Alzheimer's disease and cancer, and to **improve their treatment**.

We develop laboratory animal models to mimic the diseases we study. These models allow us to test **new medicines** for effectiveness and lack of side effects before they are used in patients.

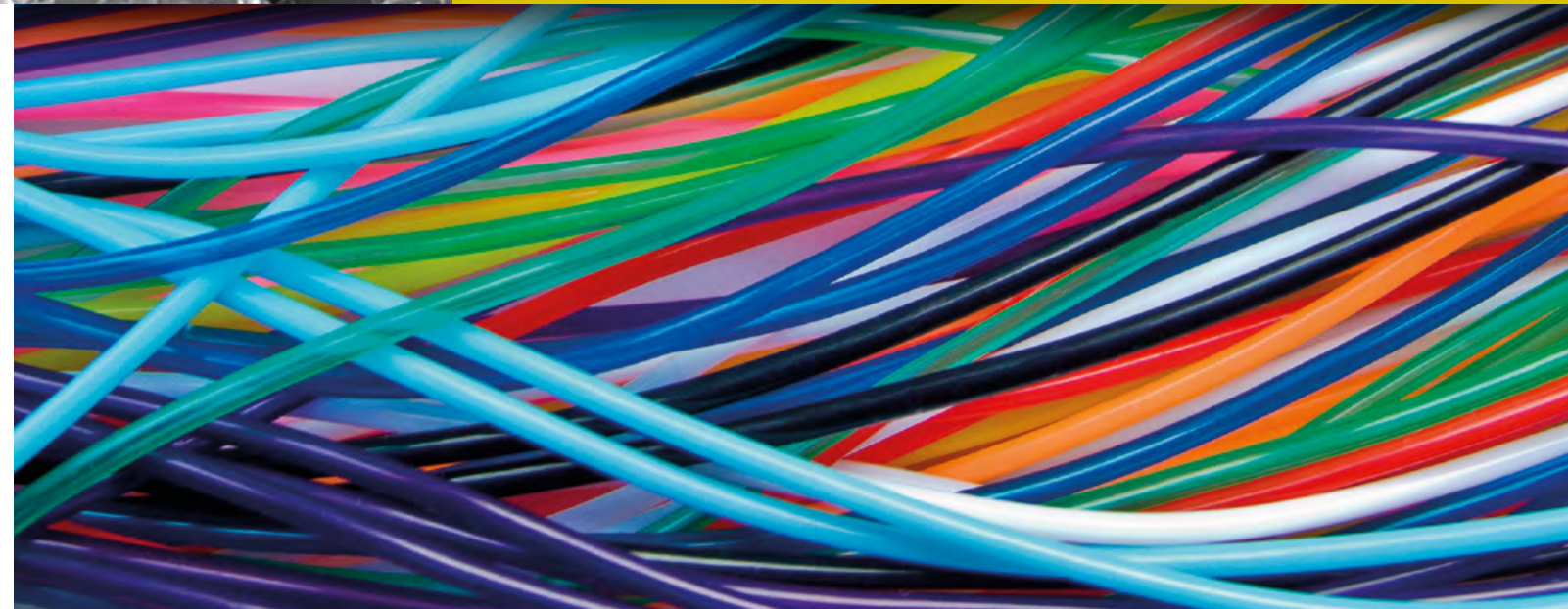
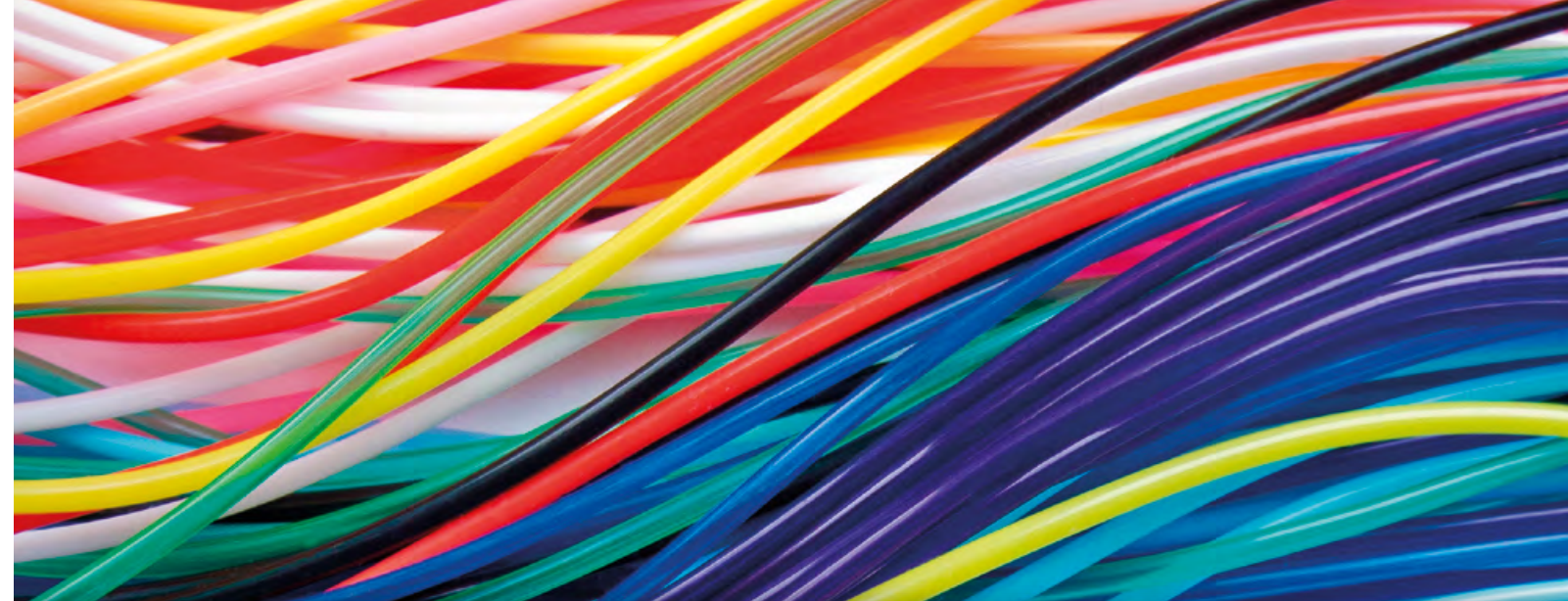


The incidence of neurodegenerative diseases increases exponentially with age. We recently patented a series of compounds that improve the quality of life of Huntington's or Alzheimer's disease patients.



Cancer incidence also increases with age. At the CNB, we have generated bacteria harmless to the human body, whose membranes bear proteins that act like microscopic syringes to inject substances into human cells for diagnostic or therapeutic purposes. In the not-too-distant future, such bacteria might act as 'micro-robots' to detect and destroy tumours.

New biotechnological approaches will allow us to design therapeutic tools never before possible.







# agriculture

## Crops to combat food shortages

To feed the world's growing population and to counter the effects of climate change, we must **design new forms of agricultural production** that are **cost-effective and environmentally sustainable**. To alleviate hunger in some parts of the planet with extreme climates, we need plant varieties that can be **grown in unfavourable** light, water, temperature and soil conditions.

To improve food production, we study how plants develop and how they react to **environmental changes**. This allows us to obtain new crop varieties that are productive in **adverse climates**, resistant to pests, and require less fertilizer to grow.

Today's biotechnology can improve crop adaptation to adverse environmental factors. At the CNB, we obtained a potato variety that can be grown in climates in which tubers normally barely form; this could help to alleviate hunger in disadvantaged regions.



**Potatoes grown in extreme temperature conditions**

- 1. Common European potato variety
- 2. Potato variety obtained in the CNB



In the extraordinary ability of plants to defend themselves against stress, we find the molecular keys we use to select better-adapted crops and meet the challenge of climate change.







# environment

## Biotechnological strategies to **remove toxic substances**

About one-fifth of the total disease burden in industrialized countries can be attributed to environmental factors. In nature, **microbes and plants** help to eliminate waste that pollutes our ecosystem.

At the CNB, we study how we can best use the natural abilities of these organisms to **clean up oil spills** or **absorb carcinogens** from the soil. In this way, we hope to alleviate environmental and health threats caused by **soil and water pollution** with toxic substances.

Arsenic, a naturally occurring element in the earth's crust that is also used in many industrial processes, can be dissolved in groundwater in the form of arsenate, one of the most potent carcinogens known.



Detailed knowledge of plant and bacterial metabolism will allow us to design biotechnological strategies to protect the environment.



The public health threat associated with arsenate derives from the use of contaminated water for drinking, cooking, and irrigation of food crops. At the CNB, we attempt to obtain plants that assimilate and retain environmental arsenate, to limit its harmful effects on human health.





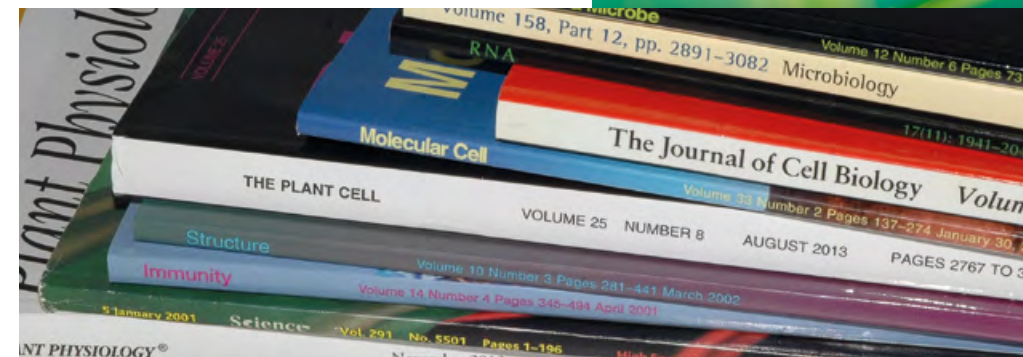


# quality

Each of our **scientific publications** reflects the quality of our research. The results of our work are published in **renowned international journals** and are frequently cited in the scientific literature.

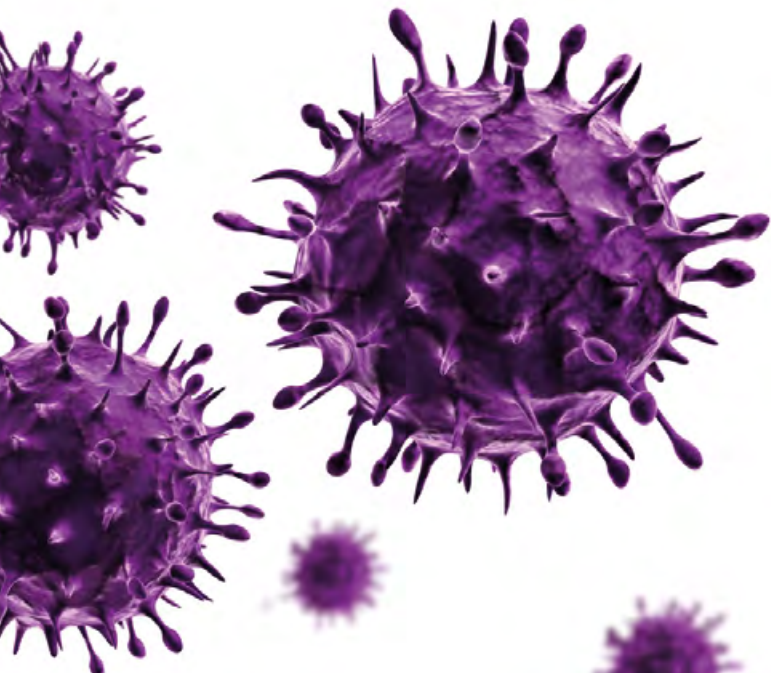
The CNB is advised by an **international scientific committee**, which makes recommendations to the centre's scientists and directorship as to how to improve the **quality** and **relevance** of their research projects. The committee also evaluates the **performance** of individual researchers and the centre as a whole.

A report by experts from the European Molecular Biology Organization (EMBO) positions the CNB "at the forefront of European and world science". In 2014, the Spanish government designated the CNB as a *Severo Ochoa* Centre of Excellence.



The proportion of scientific articles published in high-impact journals places the CNB among the world's top 50 centres for life science research, and among the top five in Spain.

Since its inauguration in 1992, CNB researchers have published more than 3,000 articles in distinguished scientific journals, and have been cited more than 100,000 times by other researchers worldwide. Based on standardised bibliometric indices, the quality of these publications is nearly twice the world average as compared to other research centres.





# technology

At the CNB, we develop **cutting-edge technologies** in genomics, proteomics, protein structure, bioinformatics and computational biology. Our centre coordinates the technological capabilities of Spain in the field of proteomics, and is the Spanish hub for the **Human Proteome Project**.

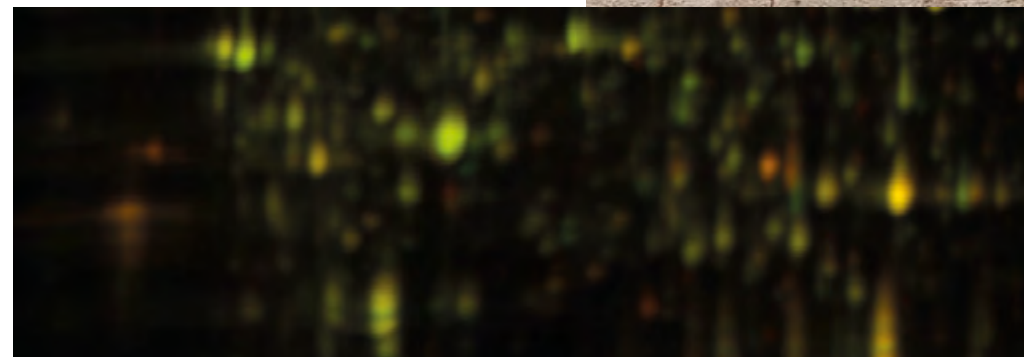
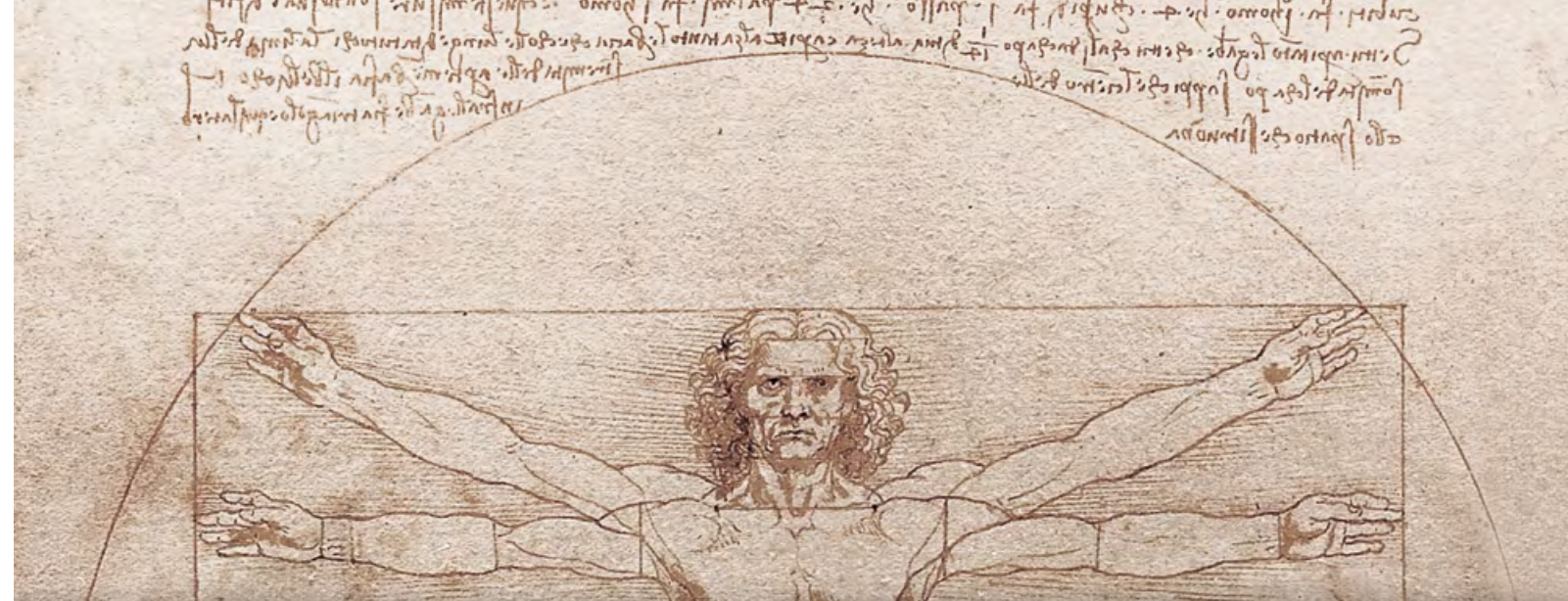
The CNB was selected by the European Commission (EC) to host the *Instruct Image Processing Centre* (I2PC), the **European reference centre** for processing protein structure images, which are obtained using the most advanced electron microscopy and X-ray techniques. In addition, the CNB is the Spanish node of the pan-European *EMMA/Infrafrontier network*, created by the EC to provide the scientific community with the mouse models they need to study and validate new disease treatments.

These R&D platforms complement one another and converge on a common goal of **discovering all the proteins** in an organism, determining their structure, and deciphering their biological function.

Our broad methodological framework and our multidisciplinary approach, which also cover knowledge areas such as mathematics and engineering, have allowed us to take on the technological challenge of analysing large amounts of data.

We devise new strategies to address the challenge of comprehensive analysis of genes, proteins and metabolites in a living organism. Such developments led to the foundation of the biotechnology companies *Integromics* and *Proteobotics*, spearheaded by CNB researchers.

The development of proprietary technologies in the areas of structural and functional biology is one of the CNB's principal strengths.





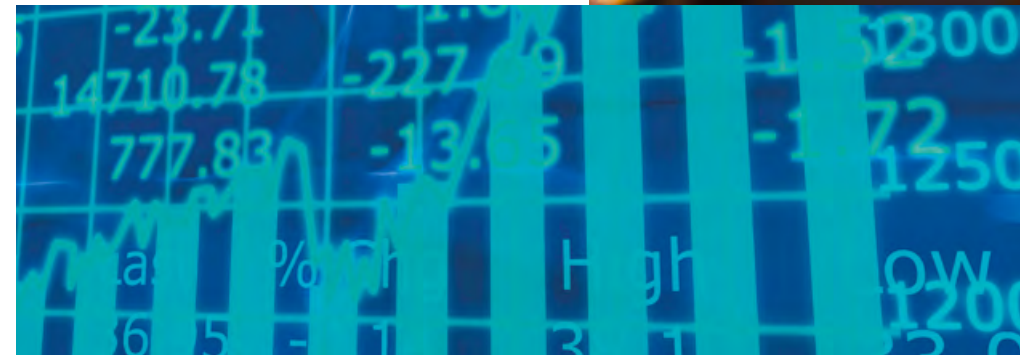


# innovation

The CNB has a **Technology Transfer Office** to optimise the centre's interaction with enterprise. Activities include protection of intellectual and industrial property rights, licensing patents and inventions, and organising meetings between researchers and entrepreneurs. We work with **companies** to develop research projects funded by national and international entities. We promote and facilitate research in companies through a broad portfolio of **scientific and technological services**.

In addition, we offer companies **experimental models** developed in bacteria, plants and laboratory animals, as well as the facilities necessary for **in vitro** and **in vivo** studies that require special biosecurity measures. We also offer consulting services and technical training programmes.

Our work benefits the productive sector through knowledge and technology transfer. Of the 100 patent applications made in the last five years by the CNB, 17 have been licensed to biotech companies.

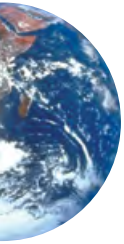


We transform scientific results from our research laboratories into business activities and social benefits.

In addition, our researchers have co-founded several technology-based companies. In the past five years, the CNB billed more than 800 operations for total value of 16 million euros for the provision of scientific/ technological services and research contracts to companies.







# training

Each year, **more than 30 doctoral theses** are defended, based on work done under the supervision of CNB researchers. Many CNB-trained scientists now occupy **leadership** positions in various academic and business areas.

The organisation of international conferences and other training activities help us to maintain a **dialogue with the international scientific community** and to enhance the visibility of Spanish science in the world.

Our **seminars, courses and workshops** cover various scientific and professional levels, and their quality and timeliness are widely acknowledged. These activities are open to participation by students, researchers and other professionals in biotechnology-related areas.



At present, more than 200 students are working toward a master's or a doctoral degree at the CNB.

Approximately one-third come from other countries, highlighting the excellent international reputation of our centre.



The CNB collaborates closely with the Universidad Autónoma of Madrid (UAM). Together with other CSIC research centres on the Cantoblanco campus, the CNB forms part of the UAM+CSIC Campus of International Excellence, which represents one of the most important research and education clusters in Spain.

## An environment that inspires enthusiasm for science

“My training at the CNB provided a multidisciplinary environment in which I learned to enjoy research and to discover the variety of experimental approaches and open-mindedness that allowed me to tackle a research career. But perhaps the most important aspect was to become engaged in an environment that generates enthusiasm for the day-to-day work. Such opportunities to enjoy science are one of the most inspiring experiences for future generations of scientists who undertake a doctoral thesis.”

**Óscar Llorca.** Research Professor at the Centre for Biological Research, Madrid, Spain

We educate future generations of scientists and technologists by offering top-quality training in the most important areas of contemporary biology.



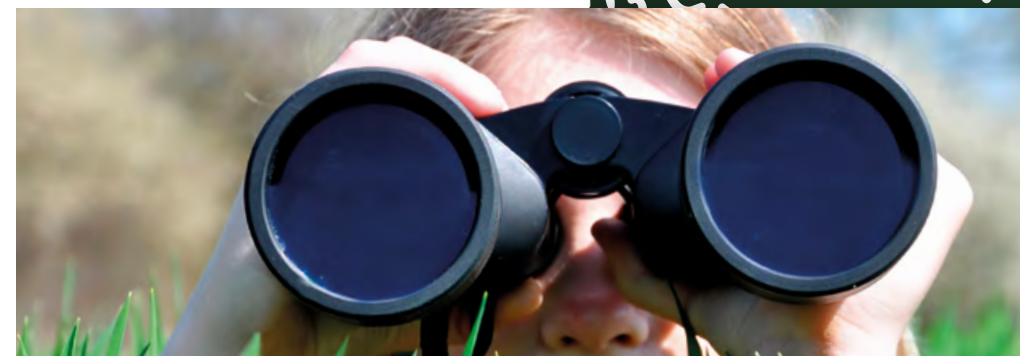


# outreach

**More than 500 people** every year, mainly high school students but also national and international delegations from governments and companies, participate in **guided visits and open-house days** to see first-hand what we do at the CNB and the results of our work.

Through distribution of press releases, participation in radio and television broadcasts, publication of newspaper and magazine articles and blogs, **we inform citizens** of the benefits and potential risks of biotechnology.

The CNB Outreach and Communications Office is also responsible for scientific communication through our website, where we offer educational content and teaching materials tailored to all audiences, from elementary students and their teachers to science professionals.

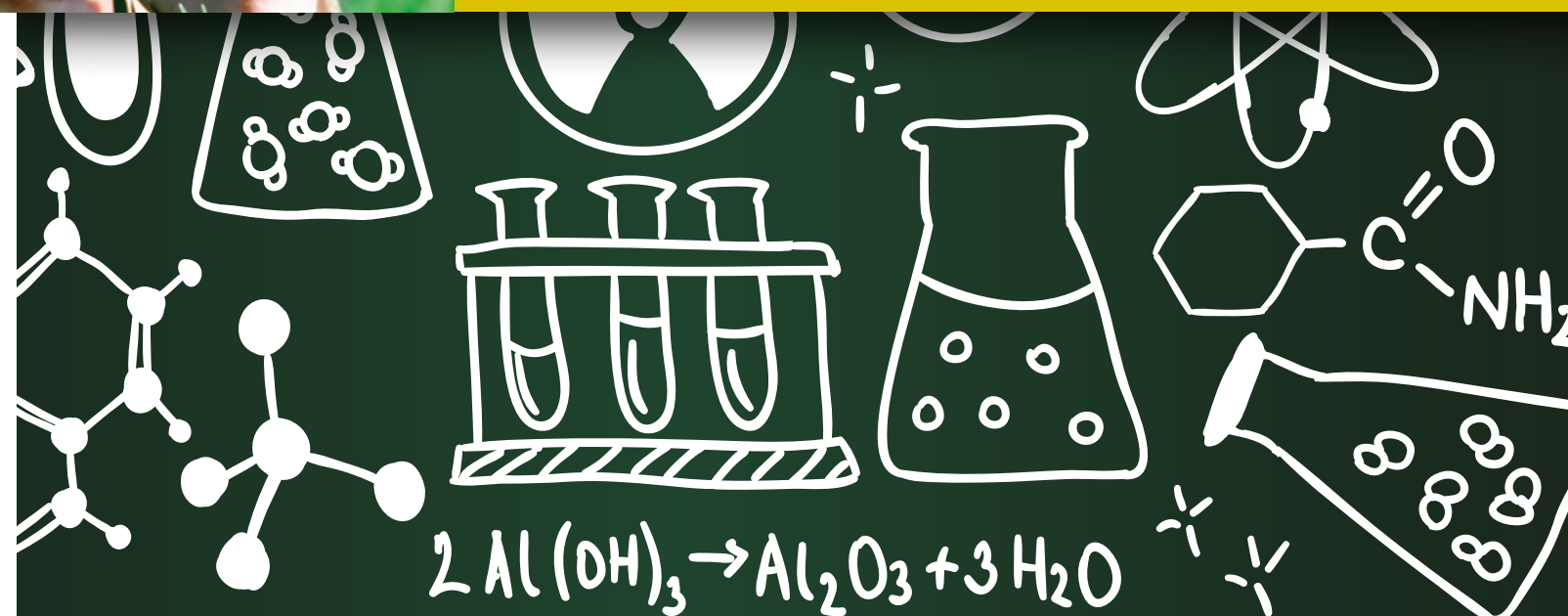
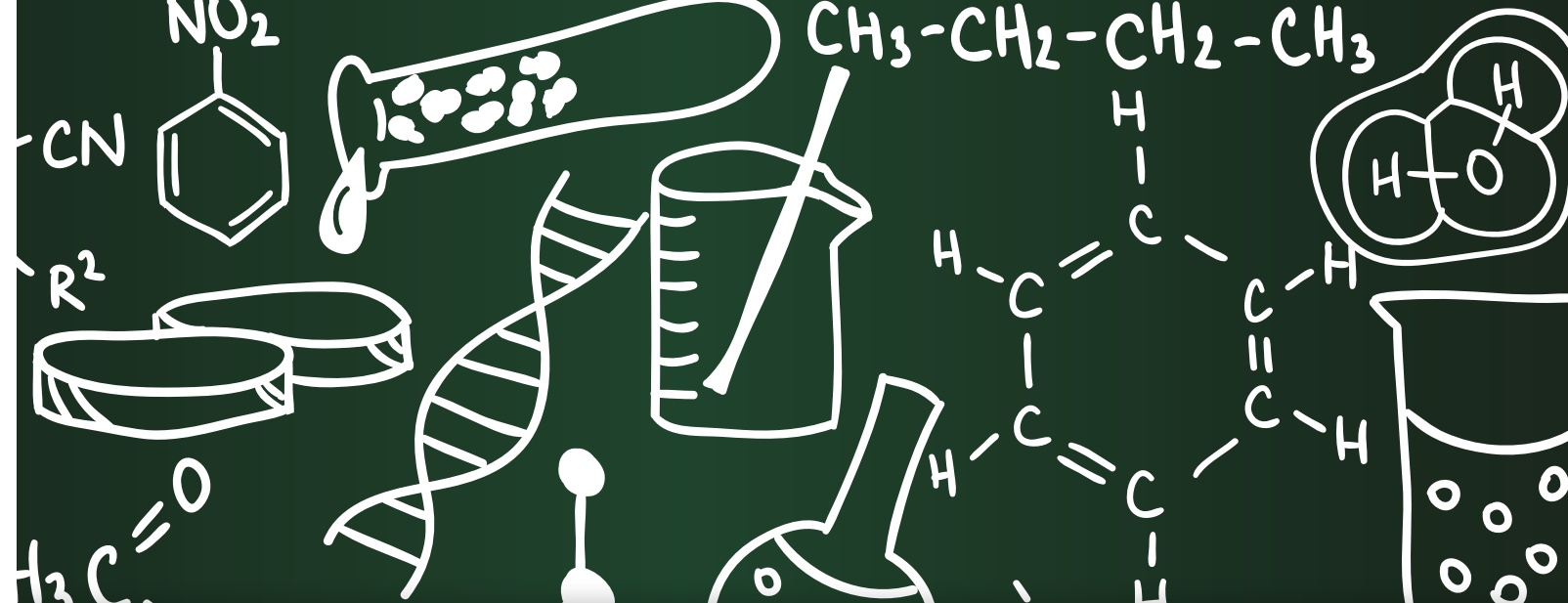


Our Outreach and Communications Office engages society by providing information on recent biotechnological advances.

This office also promotes the centre's presence in social networks, providing up-to-date information to generate public awareness of the CNB and bring biotechnology closer to society.

**Get to know us better:**

[www.cnb.csic.es](http://www.cnb.csic.es)  
[www.facebook.com/CNB.csic](https://www.facebook.com/CNB.csic)  
[twitter.com/CNB\\_CSIC](https://twitter.com/CNB_CSIC)  
[www.pinterest.com/cnbcsic](https://www.pinterest.com/cnbcsic)







# funding

The major part of research at the CNB is financed with funds raised by the centre's researchers, through **competitive research grants and industrial research contracts**.

More than a quarter of our projects are **funded by the European Commission** (among them, the Starting and Advanced Grants awarded by the European Research Council).

Successful applications for international projects allow us to maintain research **quality** and **competitiveness** and mitigate the negative impact of the recent budget adjustments by the Spanish administration.

## Our revenues

Our annual budget of approximately **20 million euros** includes both state financing and revenues obtained through funding of research projects, scientific services and contracts with industry.

42%

**Research projects**  
Research supported by national and international funding agencies and foundations



42%

**State financing**  
Funds provided by the CSIC to cover part of costs of the centre's staff, infrastructure and maintenance

16%

**Services and contracts**  
Delivery of scientific/technical services and R&D contracts with industry and other entities  
(2013 data)



Our work is funded by government agencies, foundations and international companies who trust the quality of our research and our ability to deliver cutting-edge technology.



# OUR THANKS

to those who support our commitment to quality in research, innovation,  
training and communication.

## SPANISH ENTITIES



## INTERNATIONAL ENTITIES



**Centro Nacional de Biotecnología**  
Campus de Cantoblanco  
Darwin 3, Madrid 28049, Spain  
[www.cnb.csic.es](http://www.cnb.csic.es)

Legal registry: M-7730-2014





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