# ADVANCES IN LIFE SCIENCES AROUND THE WORLD, WITHIN REACH OF SPANISH SCIENTISTS (AND VICE VERSA)

Networks like REDIRIS connect research centres, driving the global exchange of knowledge in life sciences.

## Objective: to discover the essence of life in order to improve its conditions

Towards the end of the twentieth century, life sciences took centre stage in society's breakthroughs, with projects like the first genetically modified crops, the Human Genome Project and the cloning of the first mammal. In parallel, genetic engineering, biotechnology, bioinformatics, metagenomics and biobanks were being developed, concepts that probably remain unknown to much of the population.

Today we speak of thousands of genomes, not only in humans, but other animal and plant species, and how the experiments are contributing to extraordinary progress in areas relevant to society, such as medicine and agriculture. Molecular biology is a cornerstone of this scientific field.

## Molecular biology and its huge data production

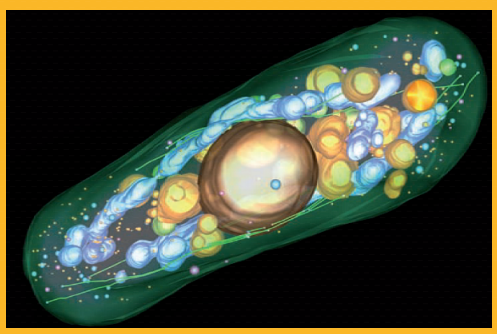
The traditional molecular biology methods are currently complemented by techniques and knowledge from other fields, such as biomedicine, physics, chemistry, IT and engineering. Biologists face the challenge of not only analysing their own, increasingly numerous primary data, but interpreting an overwhelming amount of multidisciplinary information contained in public databases. Genome sequencing alone produces terabytes of data. Biology is considered a science of big data, with a very significant computational element.

The transmission of these data, under optimum conditions of speed, security and integrity, is of primary interest to developers of molecular data infrastructure, which poses significant challenges to information and communication technology (ICT). In the case of our country, RedIRIS, the national network of advanced communications for academic and research centres, works closely with regional and international academic networks to respond appropriately to these challenges.

## EMBL: The world's leading molecular research centre

The European Molecular Biology Laboratory (EMBL) is a world leader in the research and development of basic molecular technology, with 20 member states (including Spain) and two associated states. The institution's central node is the European Bioinformatics Institute (EMBL-EBI, UK), the largest provider of biological information in the world.

Spanish researchers can access EMBL-EBI databases with a maximum quality guarantee, since RedIRIS connected the Spanish Supercomputing Network (RES) with fibre optic nodes, and this to the leading European centres through the pan-European GÉANT academic network.



Electron tomography

*"Participation in ELIXIR gives the Spanish scientific community the opportunity to access basic resources for analysing genomic data, while significantly increasing the visibility of our bioinformatics systems and facilitating our participation in large genomic projects. The National Institute of Bioinformatics (INB-ISCIII) is fully immersed in the process of consolidating European bioinformatic resources. The fibre optic connectivity offered by RedIRIS is undoubtedly a technological pillar on which this project is based".*

Alfonso Valencia, Director of the National Institute of Bioinformatics (INB-ISCIII)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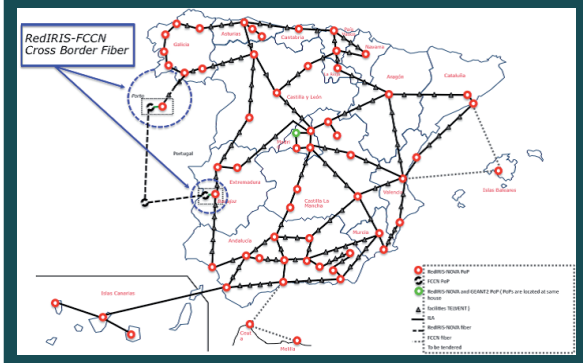
## The ELIXIR Project

ELIXIR (European Life-science Infrastructure for Biological Information) was established as a research infrastructure aimed at guaranteeing an adequate generation, quality control and storage process for the vast amount of biological data and information generated in the field of biomedicine, bioinformatics, biotechnology and of Life Sciences in general.

ELIXIR, the leading European project in this field with 32 participating members from thirteen countries, including Spain, has been selected by the ESFRI (European Strategy Forum on Research Infrastructures) as one of three high-priority scientific infrastructures at the European level.




RedIRIS-FCCN Topology

### Ethics control in molecular research

Scientists in the life sciences field are committed to respecting bioethics codes whose objective is to prevent experiments from crossing certain lines, without which the very nature of human beings, animals and plants of current and future generations could be threatened. However, sometimes the results of specific research projects provoke ethical debates in the field of science, industry and society.

### Molecular biology and medicine

Over six thousand diseases have a clear hereditary origin, although in only 3% of these cases has the responsible gene been identified. Knowledge associated with the genome can help the prevention, diagnosis and treatment of diseases like Alzheimer's, Down's syndrome, Parkinson's and heart disease, as well as cancer, the detection of autism and infectious diseases. Advances are so spectacular that there is already talk of pharmacogenomics, which establishes a direct relationship between the genetic profile of the patient and their therapeutic response to drugs.

## Spanish participation in ELIXIR

ELIXIR is organised in a network structure with a central node in the EMBL-EBI and other nodes in the different participating countries. The National Institute of Bioinformatics (INB-ISCIII) participated in the launch phase of ELIXIR, which became a legal entity in December 2013. Spain is currently in the process of formally joining the ELIXIR Consortium and, in the meantime, has signed a collaboration agreement.

Each node contributes to the platform with a Scientific-Technical Programme that has been previously approved by the direction of ELIXIR and whose execution is carried out by a Director and Technical Director who work with the central node and the other nodes within the framework of the project's common European strategy.

At a national level, the INB coordinates the data generated from nine Spanish centres specialising in genomics, bioinformatics, biomedicine, biotechnology and cancer research; this includes the National Cancer Research Centre, as the coordinator of the INB-ISCIII and the National Centre for Genome Analysis (CNAG), which is actively involved in the ELIXIR project, becoming the second largest centre in Europe dedicated to large-scale DNA sequencing projects.

The collaborative activity of these centres (all of which are intensive users of RedIRIS advanced connectivity services) puts our country in a leading role in molecular research global cooperation. Thanks to this, Spain can address many international projects such as the European Genome-phenome Archive (EGA), currently under development by the INB-ISCIII, the EBI-EMLB and the Centre for Genomic Regulation (CRG).