




Barcelona Institute of
Science and Technology

BIST ANNUAL REPORT 2019





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Barcelona Institute of
Science and Technology

BIST **ANNUAL REPORT** **2019**

BIST CENTRES



MEMBERS OF THE BOARD OF TRUSTEES



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FOREWORD





ANDREU MAS-COLELL

Chair of the Board of Trustees

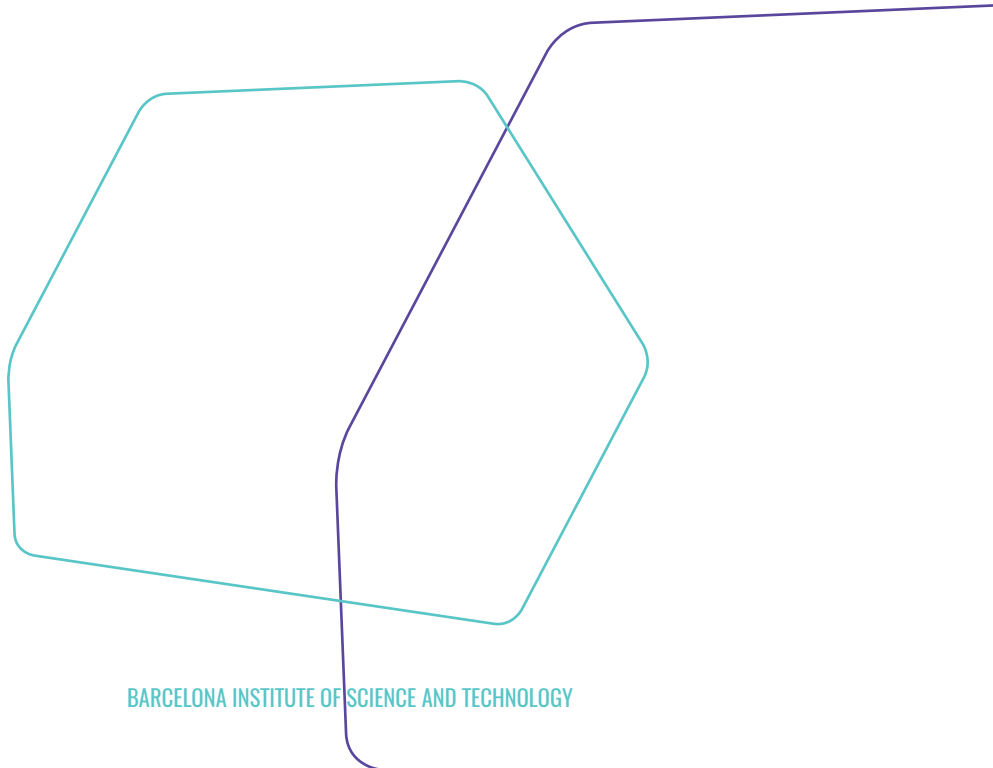
In the midst of the 2020 COVID-19 pandemic it is not the most natural exercise to be giving an account of BIST's trajectory in 2019, while abstracting from this fact. We all understand that, not only for BIST but for all institutions, the question is if our performance in 2019, and earlier, prepared us adequately for such an unexpected event. We often refer to the importance for institutions to be resilient and we try to plan in accordance, but typically it all remains in the realm of theory. The serious and unexpected does not hit every day. Yet it hit at the beginning of 2020. This is a reality check and in next year's Annual Report we will be able to assess if we were indeed resilient. I am confident we shall be able to report positively.

A BIST purpose is to incite synergies and stimulate multidisciplinary perspectives towards the solution of great scientific and social challenges, be they in health, in the environment or in the knowledge of the universe. This is to be accomplished on the strength of our centres. Inclusive of these, BIST is a large organisation. Yet BIST strict – the foundation – is, by

design, small and lean, because this is what corresponds to the type of institution we aspire to be: an exemplary instance of a public-private organisation in support of research, in our case of that emanating from our seven centres.

With this aim we do get public core funding from the Generalitat de Catalunya. We are grateful and highly encouraged by it. It is, however, very important for us that the majority of our core funding comes from philanthropic sources emerging from civil society. We want this to be our distinctive trait. I would like, therefore, to recognize the support of the foundations in our board. And also warmly thank the two foundations not in our board that in the year 2019 considered us worthy of their generosity: the Fundació Joan Ribas Araquistain and the Fundació Bosch Aymerich.

I conclude with a singular reference to Fundació Cellex that will now pass from the formal category of member of the Board to the informal one of most admired and permanently remembered founder institution. Their support at the beginning of our journey was key. We shall permanently honor the memory, and admire the vision, of Pere Mir, founder of Fundació Cellex, and great benefactor of BIST and of its centres.





GABBY SILBERMAN

Director General of BIST

The year 2019 saw important milestones in long-running and strategic projects, whose significant benefits we will see in the coming years.

One of the most substantial accomplishments of 2019 was the agreement fostered within BIST and comprising three of its centres (ICN2, IRB Barcelona, and CRG) and four other scientific organisations (Molecular Biology Institute of Barcelona [IBMB-CSIC], Institute of Materials Science of Barcelona [ICMAB-CSIC], Spanish National Research Council [CSIC] and Universitat Autònoma de Barcelona [UAB]) to jointly present two proposals to the European Regional Development Fund call for shared research infrastructures. The successful proposals obtained funds towards the purchase of two distinct advanced electron microscopy installations, one for materials and the other for biological samples, to be placed at the ALBA Synchrotron. Thus, the Barcelona research ecosystem will count with a European-level benchmark collaborative platform in advanced microscopy, starting in 2021.

Important advances were also made in two other strategic research lines, namely the international projection of the Graphene@BIST programme– with the participation of 38 BIST researchers in the 2019 Graphene Conference– and the launch of the new BIST–“la Caixa” Chemical Biology research undertaking.

In 2019, the BIST Ignite Programme continued to function as a highly effective instrument for promoting disruptive research projects through the collaboration of BIST centres. In its third year of activity, we awarded the customary five grants to new proposals, as well as three 2019 BIST Ignite Awards to the best performing projects from last year’s crop of BIST Ignite grantees. We also saw one of the prior recipients of a BIST Ignite grant, the THEIA project (now called iVision, and with broader participation) obtain a “la Caixa” Health Research Grant of close to one million euros.

Among the achievements of 2019 we proudly count the accreditation of the BIST Dolors Aleu Graduate Centre, to serve as host for our postgraduate programmes, such as the Master of Multidisciplinary Research in Experimental Sciences (MMRES). This academic programme, unique for the volume of hands-on laboratory experience it offers, saw its second class graduate and opened its third academic cycle (2019/2020) with 22 new students, 50% of them originating from eight different countries outside of Spain.

Another notable action in 2019 was the definition of our new BIST Global Science framework, a structure to expand the knowledge and tools offered to our researchers to guide their careers towards leadership in research, as well as other sectors to benefit from top scientific talent, such as science education, business, or public policy.

These are just some of the accomplishments of intense and sometimes inconspicuous work by the more than one hundred people who make up our Working Groups, the true engine of BIST. The following pages summarise this work by the BIST Community, all made possible by the valuable support of members of our Board of Trustees, as well as contributions from other collaborating entities.

ABOUT BIST

Advancing Science for a Better Future

The Barcelona Institute of Science and Technology (BIST) is an institute of multidisciplinary research built on the capabilities and aspirations of seven Catalan research centres of excellence.

- **Centre for Genomic Regulation (CRG)**
- **Institute for Bioengineering of Catalonia (IBEC)**
- **Institute of Photonic Sciences (ICFO)**
- **Institute of Chemical Research of Catalonia (ICIQ)**
- **Catalan Institute of Nanoscience and Nanotechnology (ICN2)**
- **Institute for High Energy Physics (IFAE)**
- **Institute for Research in Biomedicine (IRB Barcelona)**

Our more than 2,400 researchers, scientific and technical staff labour at the edge of science to seek disruptive solutions to treat life-threatening diseases, design innovative medical devices, build novel communications modalities, and contribute to a more sustainable world by producing clean energies and transforming pollution into useful resources.



Based on the conviction science has a key role to play in finding solutions to the urgent problems we are confronting as a society, BIST is committed to be a positive force in seeking these solutions. Our mission is to consolidate excellent multidisciplinary research across the BIST Community to answer these challenges. To do so, we provide a supportive working environment, capable of attracting outstanding talent and fostering the professional development of our diverse community. We also seek to form alliances with like-minded organisations to pursue our highly aspirational goals.

The 2019 BIST Annual Report highlights areas of significant progress made in pursuing these goals. We invite you to read it and find out more about the Barcelona Institute of Science and Technology.

BIST Centres



CENTRE FOR GENOMIC REGULATION

CRG is a Barcelona-based international biomedical research institute at the forefront of life sciences research. Its excellence is based on an interdisciplinary, motivated and creative scientific team supported by high-end and innovative technologies.



INSTITUTE FOR BIOENGINEERING OF CATALONIA

IBEC conducts interdisciplinary research of excellence at the frontiers of engineering and life sciences. Researchers generate new knowledge by combining fields like nanomedicine, biophysics, biotechnology, tissue engineering, and the applications of health information technology.



INSTITUTE OF PHOTONICS SCIENCES

ICFO conducts frontier research in diverse areas in which photonic sciences play an enabling role, also fostering the translation of the newly generated knowledge to industry, hospitals, and society at large.



INSTITUTE OF CHEMICAL RESEARCH OF CATALONIA

ICIQ is committed to research of excellence at the frontier of knowledge in two main areas: Catalysis and Renewable Energy. Research groups work on computational chemistry, CO₂ recycling, renewable fuels, catalysis and artificial photosynthesis.



CATALAN INSTITUTE OF NANOSCIENCE AND NANOTECHNOLOGY

ICN2's research generates knowledge, materials, and devices at the nanoscale for use in the broad fields of information and communication technologies, health, energy, and the environment. The ICN2 community includes over 250 members and 18 research groups.



INSTITUTE FOR HIGH ENERGY PHYSICS

IFAE conducts experimental and theoretical research at the frontiers of fundamental physics, namely particle physics, astrophysics, and cosmology. It also develops cutting-edge detector technologies, medical physics devices, and quantum computing technologies.



INSTITUTE FOR RESEARCH IN BIOMEDICINE

IRB Barcelona is a world-class research centre devoted to providing ground-breaking solutions for unmet medical needs. It hosts 26 research groups whose major research challenges are cancer and ageing.

BIST Board of Trustees



The Board of Trustees held its annual meeting at the BIST headquarters on June 25, 2019

In 2019, the BIST Board of Trustees saw some changes in its composition. In December, Mr. Antoni Vila replaced Mr. Jaume Giró as Vice-Chair, representing the "la Caixa" Foundation. In addition, at the end of the year, the Cellex Foundation, which was represented by Mr. Jordi Segarra since the very beginning, ceased to be part of the highest governing body of the institute. We thank Mr. Giró and Mr. Segarra for their dedication and support.

CHAIR

Prof Andreu Mas-Colell

VICE-CHAIR

Mr Antoni Vila

CEO of "la Caixa" Foundation

SECRETARY

Dr Eduard Vallory

DIRECTORS OF BIST CENTRES

Prof Luís Serrano

Centre for Genomic Regulation (CRG)

Prof Josep Samitier

Institute for Bioengineering of Catalonia (IBEC)

Prof Lluís Torner

Institute of Photonic Sciences (ICFO)

Prof Miquel Àngel Pericàs

Institute of Chemical Research of Catalonia (ICIQ)

Prof Pablo Ordejón

Catalan Institute of Nanoscience and Nanotechnology (ICN2)

Prof Ramon Miquel

Institute for High Energy Physics (IFAE)

Prof Francesc Posas Garriga

Institute for Research in Biomedicine (IRB Barcelona)

INSTITUTIONAL

Dr Miquel Molins

Chair of the Banc Sabadell Foundation

Mr Germán Ramón-Cortés

Chair of Catalunya-La Pedrera Foundation

Mr David Nogareda

FemCat Foundation

GOVERNMENT

Hble. Sra. Àngels Chacón

*Minister of Business and Knowledge,
Government of Catalonia*

RESEARCHERS

Prof Ignacio Cirac

Max-Planck-Institute for Quantum Optics

Prof Joan Massagué

Sloan Kettering Institute

Prof Miquel Salmeron

University of California- Berkeley

Prof Sergi Verdú

Prof Sylvia Daunert

Nanotech Institute of the University of Miami

Prof M. Carme Calderer

University of Minnesota (Twin Cities)

Prof Rolf Tarrach

European University Association

BIST Team and Working Groups

The Barcelona Institute of Science and Technology is coordinated by a number of individuals and groups including a small core team of 10 people, a Coordination Committee that brings together the Directors of the BIST centres as well as the BIST Director General, and 13 working groups which promote and facilitate

collaborations and joint projects within the BIST Community.

The BIST core team designs and coordinates all BIST joint activities in areas such as research, academic programmes, talent attraction and development, technology transfer, and communication.

BIST CORE TEAM



Gabby Silberman
Director General



Òscar Gimeno
General Manager



Núria Bayó
Head of Academic Programmes & Organizational Effectiveness



Margarita Navia
Head of Strategic Projects



Adela Farré
Head of Communications



Clara Barreneche
Head of Innovation & Business Development



Maria Yubero Gómez
International Programmes Manager



Donna M. Ramírez
Academic Programmes



Àlex Gonzalez
Office Manager & Institutional Relations



Laura Nieto
Administrative Assistant

BIST COORDINATION COMMITTEE



LUIS SERRANO

Director of the Centre for Genomic Regulation (CRG)



JOSEP SAMITIER

Director of the Institute for Bioengineering of Catalonia (IBEC)



LLUÍS TORNER

Director of The Institute of Photonic Sciences (ICFO)



MIQUEL A. PERICÀS

Director of the Institute of Chemical Research of Catalonia (ICIQ)



PABLO ORDEJÓN

Director of the Catalan Institute of Nanoscience and Nanotechnology (ICN2)



RAMON MIQUEL

Director of the Institute for High Energy Physics (IFAE)



FRANCESC POSAS

Director of the Institute for Research in Biomedicine (IRB Barcelona)



GABBY SILBERMAN

Director General of the Barcelona Institute of Science and Technology (BIST)

BIST WORKING GROUPS

*BIST Working Groups Meet-up
2019*



RESEARCH WG

Pia Cosma, CRG
Pau Gorostiza, IBEC
Niek van Hulst, ICFO
Arjan Kleij, ICIQ
Jose A. Garrido, ICN2
Sebastian Grinstein, IFAE
Angel R. Nebreda, IRB
Barcelona
Margarita Navia, BIST

INFRASTRUCTURE WG

Mònica Morales, CRG
Isabel Oliveira, IBEC
Gisela Colet, ICIQ
Gustavo A. Ceballos, ICN2
Juan Cortina, IFAE
Goretti Mallorquí, IRB
Barcelona
Margarita Navia, BIST

CHEMICAL BIOLOGY PWG

Pau Gorostiza, IBEC
Pau Ballester, ICIQ
Daniel Ruiz, ICN2
Ernest Giral, IRB Barcelona
Margarita Navia, BIST

ADVANCED OPTICAL MICROSCOPY PWG

Timo Zimmermann, CRG
Lorenzo Albertazzi, IBEC
María García-Parajo, ICFO
Pablo Loza, ICFO
Julien Colombelli, IRB
Barcelona
Margarita Navia, BIST

GRAPHENE PWG

Javier Ramón, IBEC
Frank Koppens, ICFO
Alba Rosado, ICFO
Miquel A. Pericàs, ICIQ
Jose A. Garrido, ICN2
Jose Gabriel Macías Montero,
IFAE
Margarita Navia, BIST

BIG DATA PWG

Roderic Guigó, CRG
Paul Verschure, IBEC
Oriol Bardés, ICFO
Núria López, ICIQ
Manuel Delfino, IFAE
Gonzalo Merino, IFAE
Modesto Orozco, IRB
Barcelona
Ramon Roca-Sastre, IRB
Barcelona
Gabby Silberman, BIST

ABOUT BIST

The members of the BIST core team coordinate the working groups, which meet regularly throughout the year.

The activities carried out by BIST in 2019 would not have been possible without the commitment and the contribution of the more than 100 members that make up our working groups.

KNOWLEDGE AND TECH. TRANSFER WG

Anabel Sanz, CRG
Xavier Rúbies, IBEC
Silvia Carrasco, ICFO
Frederic Ratel, ICIQ
Pablo Pomposiello, ICN2
Isaac Esparbé, IFAE
Cristina Horcajada, IRB
Barcelona
Clara Barreneche, BIST

MANAGERS WG

Bruna Vives, CRG
David Badia, IBEC
Dolors Mateu, ICFO
Lluís Solà, ICIQ
Lluís Bellafont, ICN2
Quim Bosch, IFAE
Margarida Corominas, IRB
Barcelona
Òscar Gimeno, BIST

COMMUNICATIONS WG

Glòria Lligadas, CRG
Guillermo Orts, IBEC
Brook Hardwick, ICFO
Ariadna Goenaga, ICIQ
Àlex Argemí, ICN2
Sebastián Grinschpun, IFAE
Silvia Benaiges, IRB Barcelona
Adela Farré, BIST

PEOPLE WG

Imma Falero, CRG
Damjana Kastelic, CRG
Olalla Bagues, CRG
Carolina Marí, IBEC
Anke Kleff, IBEC
Neus Vilalta, IBEC
Laia Miralles, ICFO
Mery Gil, ICFO
Leticia Chico, ICIQ
Julio Gómez, ICN2
Ana Belén Ávalos, ICN2
Quim Bosch, IFAE
Maribel Labrid, IRB
Barcelona
Leyre Caracuel, IRB
Barcelona
Núria Bayó, BIST
Maria Yubero, BIST

ACADEMIC WG

Luciano Di Croce, CRG
Elena Martinez, IBEC
Robert Sewell, ICFO
Mónica H. Pérez-Temprano, ICIQ
Arben Merkoci, ICN2
Rafel Escribano, IFAE
Roger Gomis, IRB Barcelona
Núria Bayó, BIST
Donna Ramirez, BIST

PROJECTS TF

Michela Bertero, CRG
Teresa Sanchis, IBEC
Núria Beltrí, ICFO
Lorena Tomás, ICIQ
Dulce Tienda, ICN2
Marta Balza, IFAE
Jorge Domínguez, IRB
Barcelona
Òscar Gimeno, BIST

COFUND TF

Imma Falero, CRG
Teresa Sanchis, IBEC
Victoria Ridruejo, ICFO
Rob Sewell, ICFO
Lorena Tomás, ICIQ
Julio Gómez, ICN2
Ana Belén Ávalos, ICN2
Núria Benítez, ICN2
Marta Balza, IFAE
Leyre Caracuel, IRB Barcelona
Roger Gomis, IRB Barcelona
Núria Bayó, BIST
Maria Yubero, BIST

WG = Working Group

*PWG = Programme Working
Group*

TF = Task Force

RESEARCH & INNOVATION

An abstract graphic design featuring a series of overlapping, rounded rectangular outlines in a light teal color. These shapes are arranged in a staggered, grid-like pattern that recedes into the background, creating a sense of depth and movement. The overall aesthetic is clean, modern, and scientific.

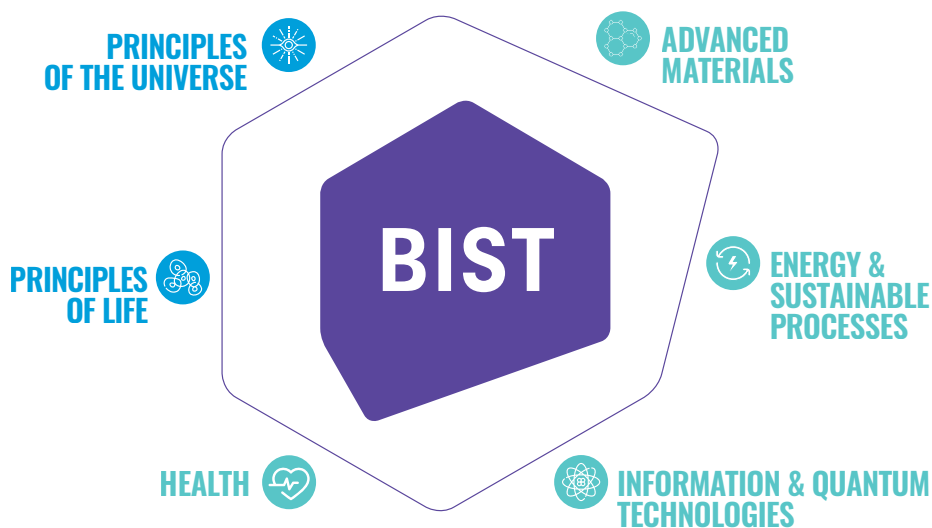
From Fundamental to Applied Research

BIST focuses on six major areas of study, two within fundamental research and the other four in the realm of applied research. The first two are principles of life and of the universe, while health, advanced materials, energy and sustainable processes, and information and quantum technologies are the four belonging to the applied category. These areas of study frame the work of more than 1,500 researchers within the BIST Community, led by 173 principal investigators —72 of them ICREA Research Professors.

The strength of BIST comes from combining the diverse capacities and perspectives of

our researchers. This allows us to develop strategic programmes in areas such as precision medicine, with a special focus on life-threatening diseases including cancer and metastasis and age-related pathologies, and energy and environmental sustainability, with a focus on fighting environmental deterioration and climate change through clean energy production.

BIST also develops strategic projects in areas such as chemical biology, big data, graphene, and precision microscopy, always seeking to articulate the interests of and benefits to the entire research ecosystem.



The year 2019 shows a positive balance for research at BIST. Our researchers received **17 new grants from the European Research Council (ERC)** in the various calls throughout 2019. This means that since the creation of the ERC programme in 2007, a total of 74 BIST researchers have received 133 of these

prestigious grants. BIST researchers also published **1,355 scientific articles** in indexed journals in 2019.

Below are some examples of the research being carried out at the BIST centres.



PRINCIPLES OF THE UNIVERSE

Discovery of the highest-energy photons from a gamma-ray burst

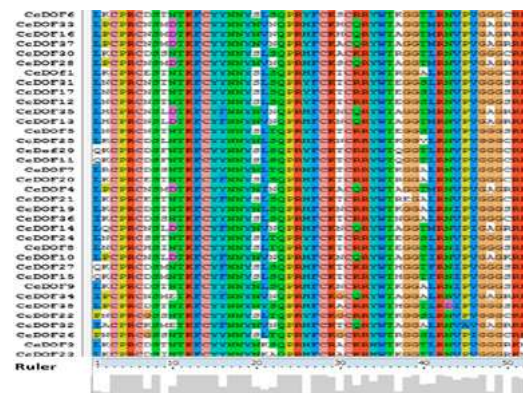
This year IFAE researchers participated in the detection with the MAGIC Telescopes of a powerful cosmic explosion called a gamma-ray burst. This study, published in two articles in *Nature* (November 2019), will allow a major understanding of these events and their energy emission.



PRINCIPLES OF LIFE

CRG's technology to study the evolution of life

CRG has developed a new tool to compare millions of genetic sequences and to determine the relation between species in order to reconstruct how life has evolved over hundreds of millions of years. [*Nature Biotechnology*, December 2019]



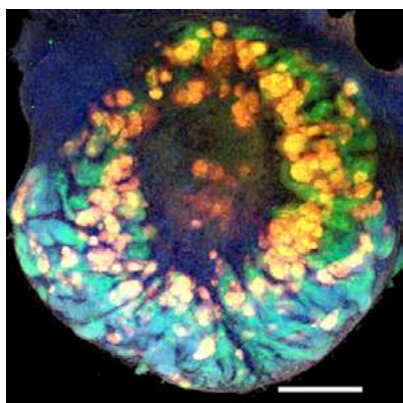


HEALTH

Mini-kidneys at IBEC for disease modelling

The group of ICREA professor Núria Montserrat at IBEC has created, for the first time, 3D organoid cultures from pluripotent stem cells. These cultures resemble human embryonic kidney tissue during the second trimester of pregnancy and will be used in renal disease modelling.

[*Nature Materials*, February 2019]



Insights into cancer therapies at IRB Barcelona

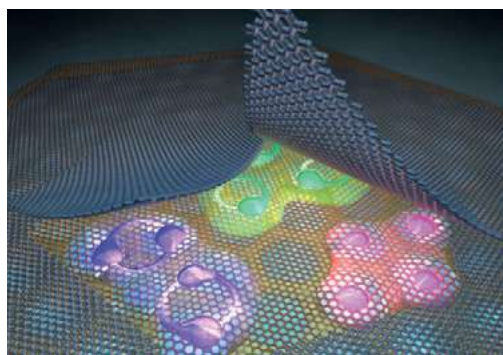
Scientists led by ICREA professor Núria López-Bigas have determined the genetic alterations in the cells of cancer patients caused by cancer therapies. This is an important step towards understanding long-term side effects and optimising cancer treatments. [*Nature Genetics*, November 2019]



ADVANCED MATERIALS

ICFO and magic-angle graphene

A team of researchers, led by ICFO Prof Dmitri Efetov, have revealed a plethora of previously unobserved states by twisting a bi-layer of graphene. The study, published in *Nature* (October 2019) and featured on the front-page of *The New York Times' Science* supplement, offers a new and richer vision of this area of physics.

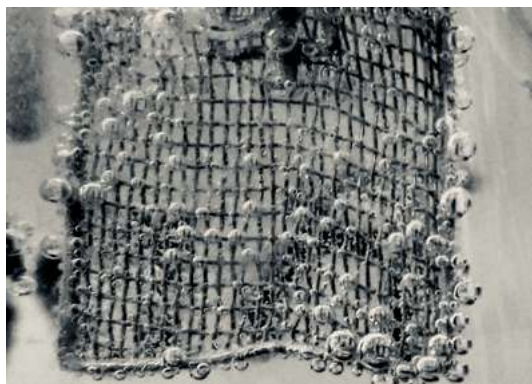




ENERGY & SUSTAINABLE PROCESSES

ICIQ brings us closer to the low-cost production of hydrogen

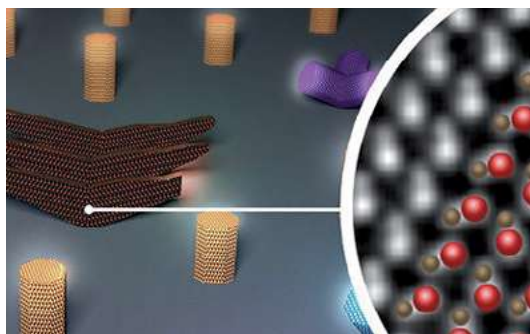
Researchers from ICIQ brought the hydrogen economy one step closer by using a magnet to directly enhance the production of hydrogen in alkaline water splitting via electrolysis. The simplicity and low cost of the technology opens new opportunities to implement magnetic enhancement in water splitting for industrial applications. [*Nature Energy*, June 2019]



INFORMATION AND QUANTUM TECHNOLOGIES

New insights for the design of quantum devices at ICN2

ICN2 presented a study providing new insights into the fine control of the polarity of semiconductor nanostructures. ICN2 and Microsoft are currently collaborating on the design of hybrid nanowire-based networks and circuits for quantum computers. [*NanoLetters*, June 2019]



BIST Ignite Programme



The BIST Ignite Programme, started in 2016, promotes the creation of multidisciplinary projects of excellence, the fruit of new collaboration among members of the BIST research community and, when possible, with external research organisations.

Every year BIST launches a competitive call for BIST Ignite project proposals and selects five winners that receive funding (20,000 euros each) to jumpstart their research collaboration. At the end of the first year of funding, two projects are selected to receive additional funding (50,000 euros each) and a BIST Ignite Award, based on the results obtained, the project's potential for impact, and the addition of new collaborators from within and outside BIST.

In 2019 five projects from the third BIST Ignite Programme call (2018) were selected to be *ignited*. The winners were the following:

- **BioSpad** (A fast monolithic multi-channel ASIC for diffuse optical, non-invasive blood flow measurement), led by Sebastian Grinstein (IFAE) and Turgut Durduran (ICFO). The project aims to explore the usage of a new generation of sensors specifically designed for diffuse correlation spectroscopy, a non-invasive technique to measure blood flow in deep tissues.
- **MOFtors** (Enzyme-powered, metal-organic framework based motors), led by Vincent Guillerme (ICN2) and Tania Patiño (IBEC). The purpose of this project is to construct for the first time enzyme-powered motors, taking advantage of a new type of solid-gas chemistry, and use them for environmental and biomedical applications.
- **ElectroSensBioBots** (Towards a new generation of programmable 3D printed living biobots with nanoelectronics for sensing and local stimulation), led by Maria Guix Noguera (IBEC) and Steven Walston (ICN2). This project wants to create hybrid robots by combining a 3D bioprinted muscle-based bio-actuator with an integrated high performing flexible graphene-based microelectrode system that allows sensing and local stimulation.
- **Organsens** (Dynamic monitoring of pancreas metabolism by combining nano-optical biosensing to organ on-a-chip technology), led by Romain Quidant (ICFO) and Javier Ramon

(IBEC). The goal of this project is to interface organ-on-a-chip platforms to integrated sensing modules, capable to monitor in real-time their biochemical response to external stimuli, like stress or drugs.

- **BioVac** (Artificial bacteria: a novel generation of bioinspired vaccines), led by Daniel Ruiz Molina (ICN2) and Eduard Torrents Serra (IBEC). This project will create capsules mimicking the size, shape and surface properties of bacteria to be used to trigger an effective protective immune response and create a new generation of vaccines.

The BIST Ignite evaluation panel congratulated the grant recipients for the high value and originality of their projects.

2019 BIST IGNITE AWARDS

Exceptionally, in 2019 the BIST Ignite Awards were awarded to three projects instead of two. The evaluation panel took into account the significant scientific contribution of the three projects and their potential to propose the awards. The three projects awarded (second phase winners of 2017 BIST Ignite call) were the following:

- **PHASE-CHROM** (Role of phase separation in gene regulation and chromatin architecture), led by Juan Andrés Torreño Piña of ICFO, Catalina Romero of CRG, and Xavier Salvatella of IRB Barcelona. The aim of this project is to study the intracellular phase segregation and to determine its role in chromatin organisation, nuclear ATP synthesis, and ultimately gene expression in breast cancer cells.
- **Q-SPET** (Quantum-controlled Single Protein Electron Transport), led by Pau Gorostiza of IBEC, Niek F. van Hulst of ICFO, and Elisabet Romero of ICIQ. This project wants to explore the light-to-charge conversion of the protein PhotoSystem-I involved in the photosynthesis using quantum technologies.
- **ENGUT** (Engineered models of intestinal epithelial tissue: assessing in vivo-like functional properties), led by Elena Martínez of IBEC, Emilio J. Gualda of ICFO, and Eduard Batlle of IRB Barcelona. The purpose of this project is to engineer intestinal epithelial tissue models that mimic physiological characteristics found in in vivo human intestinal tissue, to open up new areas of research in human intestinal diseases.

At the end of 2019, 18 projects had been awarded a total of EUR 650,000 in the different phases of the BIST Ignite Programme.

FROM THEIA TO I-VISION

The aspiration of the BIST Ignite Programme is for projects started within our scheme to make progress toward a “third phase”, to allow them to compete successfully in public and private funding calls. The year 2019 has provided us with proof, via the THEIA project, this goal is achievable. The THEIA project —supported by a BIST Ignite grant in 2017 and winner of a BIST Ignite Award in 2018— became i-VISION (Adaptive Retinal Implant Technology for Vision Restoration) and received a one million euro “la Caixa” Health Research Grant.

The original THEIA project —led by Prof José Antonio Garrido, ICREA professor at ICN2, Dr Pablo Loza-Álvarez (ICFO), Prof Mokhtar Chmeissani (IFAE) and Dr Jeroni Nadal (Barraquer Ophthalmological Center)— evolved into the i-VISION project, in collaboration with the Institut de la Vision in Paris. The aim is to develop a completely wireless, graphene-based retinal implant capable of restoring the vision of those who have been affected by retinitis pigmentosa.



Strategic Research Programmes

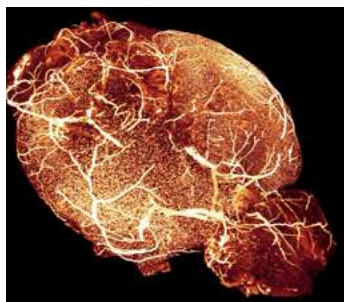
Throughout 2019 we continued to develop our strategic research programmes in the fields of chemical biology, microscopy, graphene and 2D materials, and infrastructures.

CHEMICAL BIOLOGY

In November, after securing the necessary funding, BIST took the first steps towards launching the BIST-“la Caixa” programme in Chemical Biology along with the participation of two BIST centres: IBEC and IRB Barcelona. Specifically, a call was launched to recruit a new junior group leader who will promote the programme at IRB Barcelona starting in 2020. IBEC prepared another call – launched already in early 2020 – with the aim of recruiting a new researcher to co-lead the programme.

MICROSCOPY

Microscopy is an area of high priority for BIST and its centres as developments in this field are crucial for the advancement of research in both biomedicine and new materials. Acquiring new equipment was thus a top priority and a big focus area for BIST in 2019.



On February 8, 2019, a new edition of the BIST **Symposium on Microscopy, Nanoscopy and Imaging Sciences**, which forms part of the BIST-UPF MMRES (Master of Multidisciplinary Research in Experimental Sciences) curriculum, was held at ICFO. The event, which brought together more than 145 researchers, is the result of a collaborative effort between the Advanced Optical Microscopy (AOM) Working Group and the Advanced Electronic Microscopy (AEM) Working Group.

Within the **AOM@BIST Programme**, we implemented a common virtual space for sharing protocols for sample preparation in 2019, which will be used by BIST researchers and external collaborators.

We also conducted regular visits with facility personnel to the various facilities at some of the BIST centres (CRG, ICFO, and IRB Barcelona) in order to share first-hand the ongoing activities, know-how on specific techniques and associated sample preparation protocols, and general developments. These visits have led to the establishment of most of the collaborations that we now have.

In addition, BIST established a number of transversal collaborative research and development projects at the BIST centres to increase collaboration within BIST research groups. One of these projects focuses on the design of an excitation-multiplexed multicolour imaging technique capable of single molecule imaging in living cells, and another project aims to generate high-content 3D live imaging with an oblique illumination platform for 0.05-0.5mm organoid samples.

In 2019, within the sub-area of **AEM**, nine research entities (including BIST and three of its centres: ICN2, CRG, and IRB Barcelona) submitted a proposal to the ERDF (European Regional Development Fund) call. The proposal outlined plans to buy advanced microscopy equipment: a TEM for materials research, and a Cryo-EM for structural biology research, to be installed at the ALBA Synchrotron. These microscopes will constitute the most important collaborative microscopy platform in southern Europe.



In addition, IBEC participated in a proposal led by the University of Barcelona, which was submitted to the same call for funding and which aims to acquire a scanning and transmission electron microscope (STEM).

At the time of writing this report, all three proposals have been successful and have received the requested ERDF funding.

GRAPHENE AND 2D MATERIALS

Undoubtedly, the activity that stood out most in this area last year was the **2019 Graphene Conference** in Rome, held June 25–29, 2019, in which 38 BIST researchers participated, making up 6% of the event's attendees. The conference is the largest in the world in the field of graphene and 2D materials. Researchers from the BIST centres gave 11 oral presentations and four invited talks, and chaired numerous sessions.

The Institute of Photonic Sciences (ICFO) and the Catalan Institute of Nanoscience and Nanotechnology (ICN2), both BIST centres, played leading roles in organising the conference participation. Other BIST centres involved in the **Graphene@BIST** programme, which participated in the conference, are the Institute for High Energy Physics (IFAE), the Institute for Bioengineering of Catalonia (IBEC), and the Institute of Chemical Research of Catalonia (ICIQ).

Among the BIST centre researchers presenting at the conference were invited speakers Arben Merkoci (ICN2) with a workshop on



graphene-based platforms for diagnostics, Frank Koppens (ICFO) with a plenary talk on nano-optical properties of twisted bilayer graphene near the magic angle, Sergio O. Valenzuela (ICN2) with a plenary talk on spin-orbit proximity phenomena in graphene, and Stijn Goossens (ICFO) with an industrial forum keynote talk on the integration of graphene based photodetectors and imagers for broadband sensing. ICFO Research Fellow Antoine Reserbat-Plantey also presented the Graphene@BIST initiative.

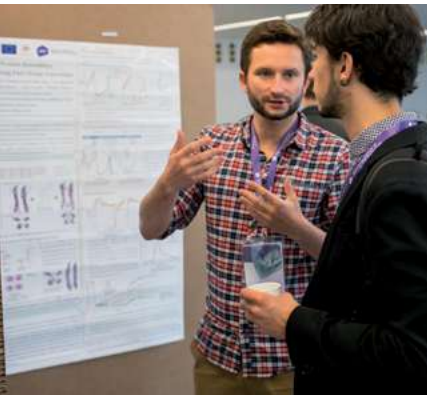
This activity was supported by the **GraphCAT** initiative, which is coordinated by ICN2 and ICFO with the participation of various other research centres and companies in Catalonia. The objective of this initiative, funded by the European Regional Development Fund (ERDF), is to promote valorisation and technology transfer of graphene and 2D materials research advancements.

INFRASTRUCTURES

Throughout 2019, we have continued to work on promoting more efficient use of the scientific infrastructures in the BIST Community. Specifically, the joint online catalog launched in 2018 was consolidated and can now be accessed through the BIST website (<https://bist.eu/facilities>). The OpenIris programme has also been implemented at some of the BIST centres, which allows them to manage and share information about their infrastructures.

As well as boosting these strategic programmes, BIST supports its centres in identifying new areas of collaboration for cross-cutting research. To that end, we hosted the **BIST Workshop on Detector Technologies for High Energy Physics** on July 12, 2019. The goal of this one-day event, which 40 researchers attended, was to explore novel technologies in the area of materials science and nanotechnology that could make a disruptive impact on High Energy Physics instrumentation, thereby generating collaborations among various groups working on detector technology and related topics. The event was co-organised by BIST, ICN2, IFAE, and ICFO.

2019 BIST Annual Conference



The third edition of the BIST Annual Conference, focused on human health, took place on November 7 at the Centre de Cultura Contemporània de Barcelona (CCCB) and gathered nearly 250 people. The BIST Annual Conference is an opportunity for the BIST Community to present and discuss their cutting edge research, and serves to increase collaboration among groups from the centres and BIST constituents.

The programme of the 2019 BIST Conference included a roundtable focused on new approaches to optogenetic neuronal control. The dialogue included remarks by **Valentina Emiliani** (The Vision Institute, Paris), **Maria Pia Cosma** (CRG, ICREA), **Ernest Giralt** (IRB Barcelona), and **Michael Krieg** (ICFO). Professor Krieg gave an introduction to the optogenetics technique in place of Edward Boyden (Massachusetts Institute of Technology) who was unfortunately unable to participate due to last minute



logistical issues. Professor Emiliani, internationally recognised for her pioneering research in new techniques for 3D optogenetics neural control, delivered the keynote speech on “Wave-front shaping and all-optical neuronal circuits interrogation”.

The conference also included presentations by PROBIST Postdoctoral Researchers, BIST International PhD Fellows, and BIST Ignite Grant winners about their multidisciplinary research. The event concluded with a poster session, sponsored by the company Eodyne, as well as a networking hour.



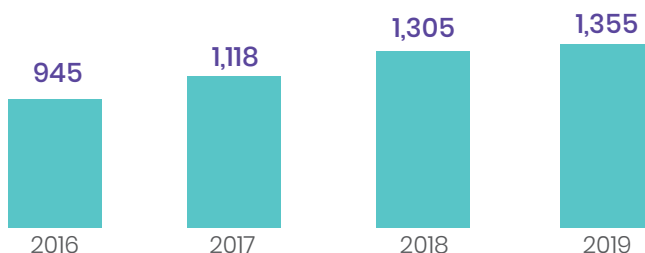
BIST Scientific Publications

Researchers at BIST centres have been signing all scientific publications with an affiliation to the Barcelona Institute of Science and Technology since October 2015, resulting in an immediate and significant impact on the visibility of the quality research done at the BIST centres, both at the local and international levels.

This visibility is based on a **total of 4,767 papers published by BIST authors** during the period from October 2015 to December 2019. In 2,436 of these (51.1%), BIST researchers occupy notable positions (main author and/or corresponding author).

According to the publications indexed in the Web of Science and Scopus databases, researchers of the seven BIST centres published **1,355 original articles in 2019**. Counting from when the practice of showing a BIST affiliation started, the number of publications has increased year-over-year in every year, placing BIST in a distinguished position on the Nature Index: **127th worldwide and 27th in Europe** (as of November 2019).

PUBLICATIONS BY BIST CENTRES PER YEAR



Source: Web of Science Core Collection and Scopus.



Turning our attention back to the total output from October 2015 to December 2019, and looking at international collaboration, we count 3,328 documents (69.8% of the total) as published jointly with research entities from other countries. This indicator is considered a measure of the standing of an institution in a global science context. The level achieved by BIST, almost 70%, is higher than the values for the whole of Catalonia (62.6%) and Spain (55.8%), as well as higher than the corresponding figures for France (62.6%), the United Kingdom (61.5%), Germany (58.3%), and the United States (41.2%).

Looking now at internal collaboration among researchers from different BIST centres, 88 publications (1.9% of the total) have been identified as having co-authors from more than one centre. One year ago, this “collaboration indicator” was 1.5%.

To get a sense of the impact of BIST publications we examine the number of citations in the Scopus database. This database shows a cumulative 68,983 citations in 52 months, with an average of 14.69 citations per publication (in 2018, the average was 10.17). It is worth mentioning the 25 most-cited publications accumulated 10,346 citations, 15% of the total.

Finally, an overwhelming majority of BIST publications are found in journals of the first quartile (Q1). In 2019, total publications in Q1 journals were 77.5%, according to the Journal Citation Reports, and 88.6%, as shown in the Scimago Journal Rank. Not counting proceedings papers, the numbers rise to 80.8% and 92.3%, respectively. These percentages are higher than Catalonia (56.5%), the United Kingdom (55%), Spain (52.7%), France (52.1%), the United States (51.3%), and Germany (51.1%).

Fostering Innovation and Technology Transfer

The commitment of our researchers to respond to the greatest challenges our society faces today, in areas such as health or environmental sustainability, is complemented by the continuous effort BIST and its centres are making to promote the transfer of technology to the private sector. We do this through actively participating in organisations and programmes aimed at boosting innovation and entrepreneurship, and developing partnerships with public and private entities. The most visible outcomes of these initiatives are the new spin-offs created in 2019.

BIST AND EIT HEALTH



In 2018, BIST became a core partner of the EIT Health consortium, a network of best-in-class health innovators backed by the European Union.

In 2019 BIST strengthened its position within EIT Health, first, through organising workshops in Barcelona with the directors of EIT Health Spain and representatives from the BIST centres, and second, through actively participating in meetings and events organised by EIT Health across Europe. This level of engagement allowed us to inform our researchers about opportunities offered by the various programmes within the three EIT Health pillars (Innovation, Campus, Acceleration), to position ourselves as a key provider of science and technology in the health sector, and to identify

potential new collaborations within the BIST Community, and with other European leading institutions, both public and private.

Specifically, BIST took part in two EIT Health matchmaking events, one taking place February 5-7 in Berlin, which gathered the majority of the approximately 150 European partners, and another from December 3-4 in Paris, with 300 participants. The purpose of these events was to facilitate networking among the many EIT Health partners and to encourage the development of joint projects.



The December EIT Health Summit in Paris serves as its annual congress that takes place in a different European city every year, and brings together about 1,000 members of the EIT Health community. The event gave us the opportunity to hold meetings with several speakers and key players in the health sector in Europe. Another highlight of the event was an Innovation Fair, where topics included innovative solutions to market challenges,

the potential power of technology in bringing ideas to the market, and how to increase impact on patients and citizens, among others.

EXPANDING THE BIST COLLABORATION NETWORK

BIST and the BIST centres strive to continuously expand their network of relationships with key players in the field of knowledge, innovation and technology transfer.

Within this framework, BIST visited international institutions of reference in London, UK, on March 19–21, 2019, including the **Francis Crick Institute, Imperial College London, and Catapult UK Cell and Gene Therapy**, in order to exchange best practices and explore possible avenues for collaboration. We also started to build a collaborative relationship with **YEDA**, the commercial arm of the Weizmann Institute of Science in Israel.

BIST presented at the **I2 Workshop on Technology Transfer** in Barcelona on October 24–25. The event was organised by the Catalan Institute of Nanoscience and Nanotechnology (ICN2, a BIST centre), the Institute of Materials Science of Barcelona (ICMAB-CSIC), and the ALBA Synchrotron. Its purpose was to foster opportunities for closer collaboration among research centres and companies in the area of technology transfer and innovation, and to discuss the challenges they present.

BIST visited the Francis Crick Institute in March 2019.



BEST PRACTICES AND IDENTIFYING OPPORTUNITIES



BIST works with the Knowledge and Technology Transfer (KTT) teams at the seven BIST centres to exchange experiences and best practices, to develop support tools and identify new opportunities that can benefit all KTT offices and their spin-off companies.

In 2019, the KTT Working Group identified a series of programmes and initiatives to help boost the progress of the BIST centres' spin-offs and to promote the creation of new ideas to bring science from the lab to the market. Specific initiatives include acceleration programmes for start-up companies, programmes to support the valorisation and transfer of technology, new research grants and capital fund initiatives, and collaboration opportunities with companies.

One of the priorities of the KTT Working Group is the development of entrepreneurship and innovation skills among the BIST researcher community to foster the development of new business ventures. This is why, for the fifth year BIST has organised and supported the *From Science to Business* course, held between May 27 and June 4, 2019 (see *Education & Talent* section).

NEW SPIN-OFFS

Throughout 2019, the BIST centres supported the creation of five new start-up companies.

Qilimanjaro

Qilimanjaro Quantum Tech was created in April with the scientific leadership of Dr Pol Forn-Díaz (IFAE) and Dr Artur Garcia Saez (Barcelona Supercomputing Center, BSC). The company's objective is to develop the first generation of a quantum annealing computer with algorithms that will allow for solving real industrial optimisation problems.



In May 2019, **Ona Therapeutics**, a spin-off from the BIST centre IRB Barcelona and ICREA was founded by researchers Dr Salvador Aznar-Benitah and Dr Valerie Vanhooren after receiving an investment from Sabadell Asabys. Ona Therapeutics received € 1.5M, which allowed the company to start working on the development of a new drug for the treatment of metastatic cancer.

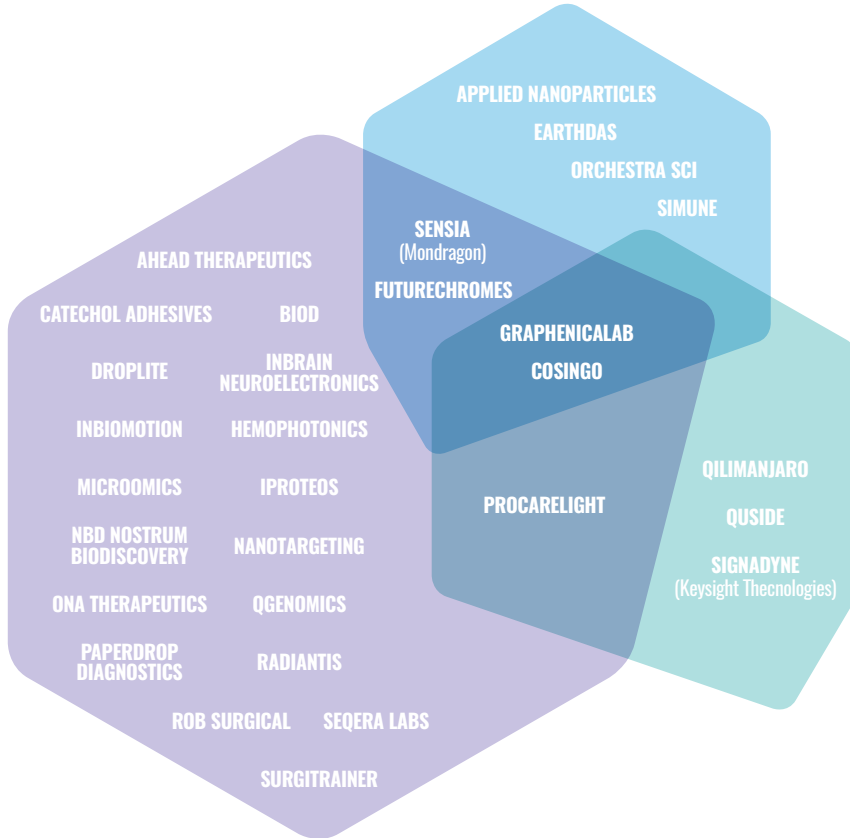


Seqera Labs, a spin-off from CRG, was founded in 2018 and joins the list of the 2019 spin-offs because it became fully operational in early 2019. Driven by CRG researchers Paolo Di Tommaso and Dr Evan Floden, Seqera has developed Nextflow, a computer solution to simplify complex data analysis pipelines in pharma and biomedicine.



At the end of 2019, ICN2 promoted the creation of two new spin-offs, **InBrain Neuroelectronics**, which builds neuroelectronic interfaces based on graphene to cure brain disorders, and **Catechol Adhesives**, which exploits the adhesive properties of catechol compounds for medical applications.

START-UPS FROM BIST




- Health / Life Sciences / Medtech
- Energy / Sustainability
- Computing / Communications / Sensing

EDUCATION & TALENT



BIST aims to attract the brightest researchers from around the world offering them a stimulating working environment and supporting the development of each step of their careers. BIST Education & Talent activities cover all the research pathway phases, from academic programmes to jumpstart scientific careers, like the BIST-UPF Master of Multidisciplinary Research in Experimental Sciences (MMRES), to courses and workshops included in the BIST Global Science programme aimed to facilitate the incorporation of talented science professionals to sectors such as education, business and public policy.

In 2019, more than 30 activities were carried out with the participation of nearly 950 people, including master and PhD students, and junior and senior researchers.



BIST-UPF Master of Research



2018-2019 graduating class

The **Master of Multidisciplinary Research in Experimental Sciences (MMRES)** is a joint academic programme of the Department of Experimental and Health Sciences of Pompeu Fabra University (DCEXS- UPF) and the Barcelona Institute of Science and Technology. This pioneering programme was launched in 2017 and since then has equipped more than 40 students with everything they need to become excellent researchers in today's multidisciplinary landscape. This full-time one year programme offers highly flexible and personalised first-hand research training in a multidisciplinary research environment.

Twenty-seven students graduated from the 2018/2019 class, 16 of which are currently pursuing PhD programmes, with half at BIST centres and the other half at institutions such as Harvard Medical

School, ETH Zürich, Saint Louis Hospital in Paris, Imperial College in the UK, Institut Curie in Paris, and Birmingham University in the UK. Some of the 2018/2019 alumni have chosen to pursue careers in the professional field, in areas such as entrepreneurship, business development, photonics engineering, and research in the private sector.

In September 2019, 22 new students coming from eight different countries —50% women— started the third edition of the MMRES. The enrollement of international students has grown steadily, which is undoubtedly a positive indicator of the attractiveness of the programme.

2019-2020 class

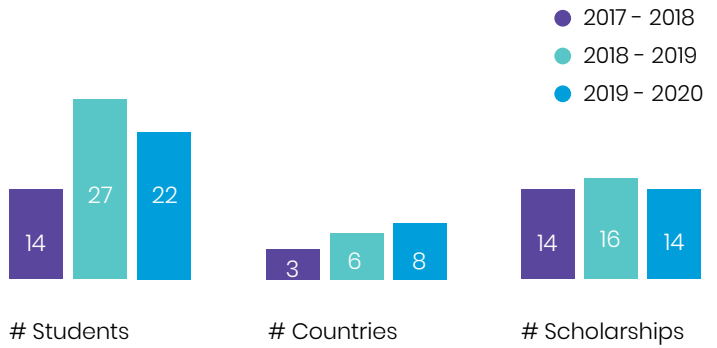


In August 2019 the BIST Dolors Aleu Graduate Centre (BIST DAGC) was also accredited by Pompeu Fabra University (UPF). The BIST DAGC will serve as the host for the MMRES. Its mission is to train researchers willing to explore the opportunities at the cutting edge of various scientific areas, especially those studied at the seven BIST centres.



Robert Sewell (ICFO), MMRES
Director

MASTER PROGRAMME FIGURES



2019 MMRES ACTIVITIES

BIST Winter School and Symposium

The 2019 BIST Winter School, which took place from January 21 to February 8, was focused on microscopy, nanoscopy, and imaging sciences, and gathered 29 researchers as instructors. Designed by the BIST scientific community, the programme included classes on theory and practical application, and culminated in the 2019 BIST Symposium on Microscopy, Nanoscopy, and Imaging Sciences, held on February 8 at ICFO. The Symposium gathered 145 attendees and was an important opportunity for the entire scientific community to learn from international experts in these fields. The MMRES students each presented a research poster at the event.

BIST Colloquium Series

From December to June, the master programme includes the BIST Colloquium Series, monthly lectures and discussion sessions with highly recognised researchers from prestigious international research centres. The colloquia provide broad exposure to cutting-edge research in experimental sciences, and offer participants direct contact with outstanding research leaders. Although put on specifically for MMRES students, the colloquia are also open to the entire scientific community.

The 2018/2019 BIST Colloquium Series featured the following speakers: **Shalev Itzkovitz**, Weizmann Institute of Science (Israel); **Agneta Nordberg**, Karolinska Institutet (Sweden); **Liedewij Laan**, Kavli Institute of Nanoscience (The Netherlands); **Andreas Hierlemann**, ETH Zürich (Switzerland); **Ana Pego**, Instituto de Engenharia Biomédica (Portugal); **Georgi Dvali**, NYU Center for Cosmology and Particle Physics (United States); and **Nicola Iovino**, Max Planck Institute of Immunobiology and Epigenetics (Germany).



BIST-UPF Master Welcome Event

On September 10, La Pedrera was the scene of the BIST-UPF Master Welcome Event which kicked off the third edition of the programme. The event served to welcome the new 2019/2020 cohort and to celebrate the graduation of the 2018/2019 class.

Graduating students Ivan Company, Maria Sanchiz, and Adam Skali hosted the event which included a keynote speech by Giuseppe Battaglia (Group Leader and ICREA Research Professor at IBEC). Professor Battaglia recently joined IBEC as leader of the Molecular Bionics Group and gave an inspirational talk about nanorobots, in which he emphasised the need for multidisciplinary in cutting-edge research like that undertaken by the students, something the BIST-UPF Master programme strongly fosters.



PhD and Postdoc Fellowship Programmes

BIST is working towards becoming an international reference in the training of researchers. This is possible in part thanks to the multidisciplinary environment created by the union of the seven excellent BIST centres, whose research is focused on fields as diverse as genetics, biomedicine, bioengineering, chemistry, photonics, nanotechnology, and fundamental physics.

The BIST PhD and postdoc fellowship programmes are important vehicles to help

us come closer to fulfilling this objective. Specifically, these programmes include the PREBIST Programme and the BIST PhD Fellowships for doctoral students, and the PROBIST Fellowship Programme for postdoctoral researchers.

PREBIST and **PROBIST** are co-funded with 10M euros through the Marie Skłodowska-Curie Actions scheme (Horizon 2020) that launched in 2017 and will run until 2021.



In 2019, the recruitment phase of the PREBIST and PROBIST programmes was completed, with a total of 28 PhD fellows and 61 postdoctoral fellows being accepted, respectively.

More specifically, a third call for applications was launched for the PREBIST programme in 2019 in order to fill the remaining four

open positions. We received a total of 140 applications in the call. Two calls were also launched for the PROBIST programme in 2019, one for 22 open positions, and the other for seven. In total, 695 and 229 candidates applied to the calls, respectively.

In addition, in the last quarter of 2019, the EU carried out a first monitoring and control inspection of the BIST COFUND programmes. BIST successfully passed the entire inspection of the selection and hiring phase, as well as the programmes' first 24 months.

In 2019, the eight doctoral students selected for the **BIST PhD Fellows** programme in 2016 finished their third year. On June 20, these fellows joined the PREBIST Fellows for a "Meet the director" event, where the students heard an inspirational talk by Klaas-Jan Tielrooij (ICN2) and had the opportunity to meet and talk with the BIST Director General, Gabby Silberman.



CAREER PROGRESS OF RESEARCH FELLOWS

Dr. Aleksandra Karolak, who joined the PROBIST Postdoctoral Programme in July 2018 as a postdoc working at IRB Barcelona, became an Assistant Research Professor at the City of Hope Comprehensive Cancer Center (California, USA) in September 2019.

"I would like to enthusiastically underline that the PROBIST fellowship played a big role in transitioning to this eagerly awaited milestone."

Career Development Programme

The Barcelona Institute of Science and Technology offers its research community an extensive programme of courses and workshops to allow them to fully develop the skills necessary to achieve success at every stage of their career, from their early PhD years to scientific leadership positions.

Our approach to the career development challenge is strongly rooted in the methodologies developed by Vitae UK, a leading global organisation focused on supporting the professional development of researchers. Vitae has a strong track record of working very successfully with institutions all over Europe. It is run by the Careers Research and Advisory Centre (CRAC), whose Board of Trustees includes Gabby Silberman, BIST Director General, as a member.

BIST participated actively in the **2019 Vitae Researcher Development International Conference** held in Birmingham from September 16–17, 2019. This annual conference is the only dedicated event that brings together all those with a strategic



and practical role in developing researchers. The 2019 event saw over 400 participants from the UK and internationally, including pro-vice-chancellors, heads of faculties, heads of graduate schools, HR directors, career advisors, staff developers, and trainers.

The BIST Director General, Gabby Silberman, chaired the session “Catalysing a culture shift in the development of research staff” at the 2019 conference. BIST also participated in the poster session about ‘Revamping postdoctoral training and education’, which focused on postdoctoral researchers transitioning to independence and long-term career prospects.

In addition, there was a significant presence of Catalan entities at the conference, including that of AGAUR, Universitat de Girona, Universitat Rovira i Virgili, Universitat de Vic, and Barcelona Biomedical Research Park (PRBB), along with representatives from several BIST centres.



COURSES AND WORKSHOPS

Our training activities are jointly designed with the training and human resources managers of the BIST centres and are complementary to the courses and seminars they themselves offer to their own teams at each institute. The 2019 BIST career development activities, listed below, gathered nearly 300 participants in total.

How to succeed in your PhD

BIST organised two editions (in January and in February) of this two-day course, designed to show first year doctoral researchers practical ways to increase their effectiveness and meet the challenges of their PhD. A total of 54 participants attended the two courses.

The course was designed and delivered by a team of local and BIST community trainers composed by Leticia Chico (ICIQ), Alicia Monleón (ICIQ), Núria Bayó (BIST), Andreu Gual (Corkscrew), and Emma Lopez (Sao).

Leadership in Action

This is an intensive three-day activity-based training course for postdoctoral researchers that in 2019 took place at the EADA-Montserrat Hotel and Training Centre from March 13-15. Forty-one participants practiced their leadership skills and gained insight into leadership theory. Specifically, they focused on developing a leadership style to help them be more impactful and effective in their workplaces. The course was designed by Vitae and delivered by a team of local and UK trainers, who were led by Caroline Broad.

Career Guidance Training Course

This course, held from February 19-22, 2019, and certified by the Association of Graduate Careers Advisory Services (AGCAS), had 14 participants. It was designed to better prepare staff for setting up one-on-one sessions with researchers to provide guidance for their career plans.



Supervising Master's Students

Held on March 11 and again on October 22, 2019, the objective of this course was to prepare PhD students and postdoctoral researchers to supervise master's students. The course offered guidance on topics such as the role of a supervisor, the required skills of the same, and effective ways to manage the needs of master's students.

GRADSchool

The aim of this course, held in May 2019 with 20 participants, was to help third year doctoral students increase their self-awareness, their professional effectiveness, and their proactivity in meeting PhD challenges and in planning for the next steps of their careers.



Leadership and Management Skills Follow-Up Course

Held at the BIST headquarters on July 8 with 10 senior group leaders, this was a tailor-made course, in which activities were designed on the go according to the needs expressed by the group. The objective was to strengthen participants' self-confidence as leaders within their institutions and to support them in better fulfilling the multitude of expectations in their professional roles. The session was provided by HFP, a leading science training company.

Leading for Success in Science

The aim of this workshop, held on the BIST premises from July 9-11, was to improve scientists' interpersonal and leadership skills in areas such as communication, organisation, leading individual and group processes, and empowering team members, among others. Fifteen people participated. The course was co-organised with PRBB-Intervals and CRG, and delivered by HFP Consulting.

Workshops co-organised with RMIT Europe

- Best Practices and Co-creation for Responsible Research and Innovation (RRI)
- Lean Start-up Research

These workshops, held at the RMIT Europe offices in Barcelona on September 16 and 18, showed participants the problems when R&D&i is tackled with a uni-dimensional approach, and the increasing need to include societal,

as well as professional, stakeholders in the R&D&I process. The 20 participants of each workshop, mostly postdocs, were introduced to the key concepts and definitions of Responsible Research and Innovation (RRI) and co-creation,

putting these into practice through a series of creative design activities. The courses were delivered by Corkscrew and trainers at RMIT.

Personal career development workshop- “Self-analysis and making career choices” by Sarah Blackford

This workshop, which was held from September 30 – October 1, 2019 on the BIST premises and delivered by Sarah Blackford, member of AGCAS, was designed specifically for PhD students and postdoctoral researchers who were considering their next career moves. The

workshop, in which 31 researchers took part, helped participants gain awareness of their skills, interests, and values, and encouraged them to link this information to the process of career decision making.

Additionally, BIST supported activities promoted from within the BIST Community, such as the first **Joint BIST PhD welcoming cool-off**, held on April 5, which gathered 70 PhD students from the seven BIST centres. The event, designed and organised by a committee of 10 PhD students from the BIST centres, kicked off with a brief overview of each BIST institute given by PhD representatives. This was followed by splitting participants into multi-disciplinary teams and playing a fun quiz about science and general knowledge. The event ended with an informal networking session.

In the same way, BIST encouraged members of its community to participate in workshops and training activities organised by a single BIST centre. Among these shared activities are the following: **Engineering genetic mutations in the mouse** (IRB Barcelona, January 29), **BCN Science Slam** (CRG, February 8), **3rd IRB Barcelona PhD Students’ Retreat** (March 22-23), **Protein Expression: basic concepts to new directions** (IRB Barcelona, June 11), **Cross cultural training** (IBEC, September 25), and **Data visualisation** (IBEC, October 17).

Women in Science

BIST organises a series of diverse activities, under the umbrella of Women in Science, to promote the professional and social recognition of women researchers and their leadership in the BIST Community. Among these activities is the biennial *To the Mothers of Science* programme, first launched in 2018, which offers financial aid and coaching sessions to researchers with children to prevent motherhood from becoming a barrier to advancing their careers towards higher positions with greater responsibilities.



BIST also launched the **BIST Trobada de 100tífiques** in February 2019 to promote the public visibility of the work done by women researchers, to bring science closer to schools and foster a research-education partnership, and to create a space for women scientists from both public and private sectors to network and cultivate future collaborations.

The event, held on February 7, 2019, gathered over 100 female scientists in the Antoni Caparrós Auditorium of the Parc Científic de Barcelona (PCB). The first objective of the meet-up was to help attendees prepare inspiring talks to deliver to school children on the International Day of Women and Girls in Science (February 11) all across Catalonia as part of the *100tífiques* programme organised jointly by BIST and the Fundació Catalana per a la Recerca i la Innovació (FCRI). The meet-up also aimed to give visibility to the contributions made by women to science and to promote female researchers as role models for future generations.

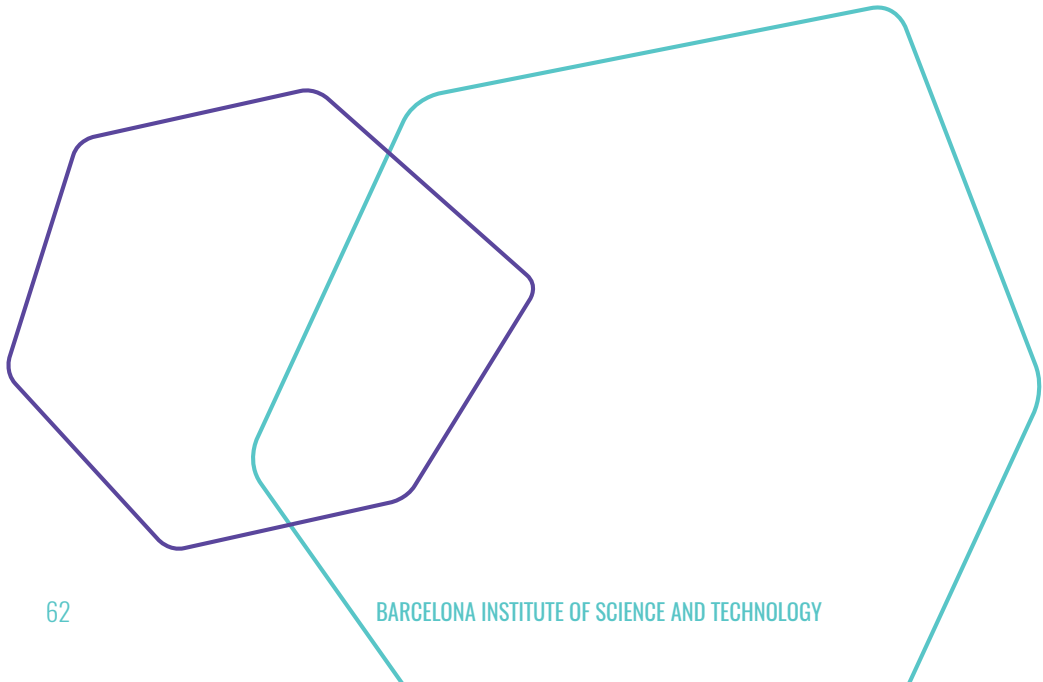
The *BIST Trobada de 100tífiques* formed part of the **Barcelona City & Science Biennial** and included the participation of the Mayor of Barcelona, **Ada Colau**, the Councillor of the Generalitat, **Elsa Artadi**, the General Director of Innovation, Research and Digital Culture of the Catalan Ministry of Education, **Mar Camacho**, the Culture Commissioner of the Barcelona City Council, **Joan Subirats**, and the President of the Institut Català de la Dona, **Núria Balada**.

BIST Global Science

One of BIST's aspirations is to put scientific talent at the service of society, training the best researchers capable of leading the science of the future, but also supporting those who decide to direct their professional careers towards other sectors where scientific knowledge can play a key role.

This is why in 2019 we defined our new BIST Global Science programme, a framework to offer our researchers the knowledge and tools necessary to guide their careers towards leadership in research, as well as other sectors that can benefit from top scientific talent. The three sectors prioritised by the new programme are **science education, business and entrepreneurship, and public policy and social engagement.**

The BIST Global Science programme includes both cross-cutting activities that offer researchers guidance on new approaches to professional development, as well as courses, meetings, and workshops with specific content for each of the three priority sectors mentioned.



BIST Career Workshop

One of several transversal activities in 2019 was the first BIST Career Workshop, organised in conjunction with the HR departments of all BIST centres. Held on October 28-29, 2019, at the Media-TIC Building of Barcelona Activa and aimed at BIST PhD students and postdoctoral researchers, this two-day workshop offered its participants tools to explore and access professional careers beyond academia. Specifically, the workshop explored areas such as project management and business entrepreneurship, and included interaction with professionals who have already made the transition from academia.



Science education

This was the umbrella under which the most activities were offered throughout 2019. The **Trobada de 100tífiques** meetup, held on February 7 and mentioned previously as part of our Women in Science programme, included the objective of presenting the teaching profession as a possible vocation for women scientists. To that end, Mar Carrió, professor and researcher in science education, and coordinator of the UPF-UOC Master in Secondary School Teachers Training delivered a speech at the event.



Along the same lines, BIST collaborated with the biotechnology company Amgen and the Fundació Catalana per a la Recerca i la Innovació (FCRI) in the **Amgen TransferCiència** programme, which launched in 2019 to improve science learning in high schools. The programme placed talented young researchers into 25 secondary schools to provide more comprehensive and complete science education for high school students and to support teachers in specific teaching areas such as genetics and biotechnology.

**TRANSFER
CIÈNCIA**



Finally, an agreement was reached between the **Fundació Catalunya La Pedrera** and BIST to launch a **Scholarship Programme to Promote Scientific Vocations in Education**. The programme targetted BIST postdoctoral researchers and last-year PhD students enrolled in one of the masters in secondary school teaching offered by various Catalan universities. Paola Chiara Bartoccioni, researcher at IRB Barcelona and UPF-UOC Master Student, was awarded this Fundació Catalunya La Pedrera Scholarship.

Business and entrepreneurship

BIST partnered once more with Esade Business School to deliver a new edition of the **From Science to Business** (FS2B) course, with the goal of developing entrepreneurship and innovation skills among the researchers in the BIST Community. The programme included a welcome event and a roundtable discussion with leading researchers and start-up founders and entrepreneurs on May 27 at the BIST headquarters, followed by a three-day course at Esade Barcelona. The course was designed for senior and postdoctoral researchers, and final year doctoral students at BIST research centres, and was attended by 27 participants. For the first time in this annual course, students worked on their own scientific projects to develop a potential business plan and, as a learning exercise, pitched in front of an investor. Learning outcomes included: getting acquainted with the business world and how companies create value, the venture creation process and the role that science/technology plays in it, and entrepreneurship as an attractive career path.

To promote entrepreneurship in the healthcare sector, Biocat and BIST also reached an agreement to offer two spots in the 2020 edition of the Biocat dHEALTH Barcelona programme at half the usual tuition cost to people in the BIST Community. **Design Health Barcelona** (dHEALTH Barcelona) is a postgraduate programme that guides multidisciplinary groups of participants through a full cycle of innovation, from needs identification to designing and prototyping a viable solution, to searching for funding.



BIST & SOCIETY



The Barcelona Institute of Science and Technology is in constant dialogue with society at various levels: institutions, companies, students, families, and the media, among others. We make communication a priority in order to share our research and to involve citizens in the effort to find solutions for the great social challenges we face today: incurable diseases, aging, climate change, and the need for clean energy for a sustainable planet.

We publicly commit ourselves to major social challenges, such as fighting climate change. So in September 2019 we launched a *BIST statement on climate crisis and global action* and planted a tree at the entrance of the BIST headquarters as a symbolic gesture with which the institution joined other global mobilisations against the climate crisis.



In order to join forces and to be as effective as possible, we also put significant effort into maintaining fluid communication and promoting networking among the nearly 2,500 members of the BIST Community.

Strengthening and Promoting the BIST Community

More than 30 events were carried out in 2019, including courses, workshops, colloquia, and scientific conferences. With these, we have had unique opportunities to foster teamwork and collaboration among various groups of the seven BIST centres, and to promote the BIST brand to both internal and external audiences.

Of these activities, it is worth highlighting the **BIST Working Groups Meet-up**, which took place on January 23 at the Palau Requesens in Barcelona and brought together more than 70 members of the BIST Community. The event featured a talk by Xavi Escalles, founder of AlwaysPeopleFirst, about how important it is to foster collaboration, how enriching having many different perspectives is, and how powerful networking and putting people first can be. The event also gave BIST the opportunity to recognise the very important contributions made by the members of the BIST working groups, technical committees, review panels, and task forces, and to welcome new members, get to know each other better, and become inspired to engage in new BIST projects.





Other important events that allowed us to build visibility of the BIST brand and to strengthen the BIST Community were undoubtedly the **100tifiques meet-up** (February 7), the **2019 Graphene Conference** (June 25-28), and the **2019 BIST Conference** (November 7), as mentioned in other chapters of this report. The 100tifiques meet-up had a very wide and very positive impact in the media, and the Graphene Conference and the BIST Conference built a strong sense of community among the delegates, and conference attendees and organisers.

In addition, the communications channels used to engage the BIST Community were enhanced through such tools as the BIST Newsletter, which we started sending on a monthly basis in September 2019 and whose number of subscribers doubled in 2019. Other online channels including social media and the BIST website were also built-up throughout 2019, as described later in this report.



Bringing Science Closer to People

In 2019 the BIST centres organized about 400 outreach activities that together reached more than 60,000 people. Bringing science closer to society is a top priority for BIST and the centres of the BIST Community are dedicated to reaching people with a variety of training and dissemination targeting diverse audiences. Some initiatives are specific to a single BIST centre, while others are joint programmes across the BIST Community. And some are also part of city-wide or global events. Here we highlight some examples.

A successful outreach project organized by a single BIST centre is the NanoEduca programme, led by ICN2, along with the UB, UAB, and CESIRE. The project, which brings nanoscience into the classroom with kits of nanoscience related educational experiments that can be used by teachers in chemistry, physics, mathematics, and even philosophy classes, was awarded the 2019 National Award for Scientific Communication at the FCRI National Research Awards Ceremony, presented every year in collaboration with the Generalitat of Catalunya.

In 2019 we also had strong participation by BIST and its centres in joint outreach events that resonated both locally and globally. Some examples are the following.

- The **City & Science Biennial**, promoted by the Barcelona City Council, took place between February 7 and 11. BIST and several of its centres collaborated with this initiative, whose aim was to bring science closer to citizens and to invite them to participate in the debate on how science can be used to respond to social challenges. We organised (or participated



in) about 17 different events of the Biennial programme, including the successful **100tífiques** meeting (see Education & Talent section).



- In September, BIST participated in the **2019 European Researchers' Night**, a mega outreach event that takes place every year on the last Friday of September simultaneously in about 300 cities all over Europe. This is a public science outreach event that aims to bring science, research, and technology closer to the public through scientific talks, workshops, and games.
- The **2019 Science Week** took place between November 8 and 17 with the participation of four BIST centres: CRG, IBEC, ICFO, and ICN2. Science Week is organised every year by the Fundació Catalana per a la Recerca i la Innovació (FCRI) and consists of workshops, talks, exhibitions, games, and more. It is also worth highlighting that the launch of the ICFO Citizen Science Experiment *NightUp* took place during last year's edition.



Finally, the BIST centres participated in several joint outreach activities throughout 2019 that relied on teamwork and collaboration among them. Two examples are the following.



The science mentorship programme **Crazy for Science**, organised by the Fundació Catalunya–La Pedrera, has different “specialties” organised by the different BIST centres: Crazy about Biomedicine (IRB Barcelona), Crazy about Chemistry (ICIQ), Crazy for Physics (ICN2 and IFAE) and Crazy about Bioengineering (IBEC). The programme is aimed at preparing first year baccalaureate students for possible careers in scientific research. About 100 students participated in the Crazy for Science programmes at the BIST centres in 2019, involving more than 50 members of the BIST Community as tutors.

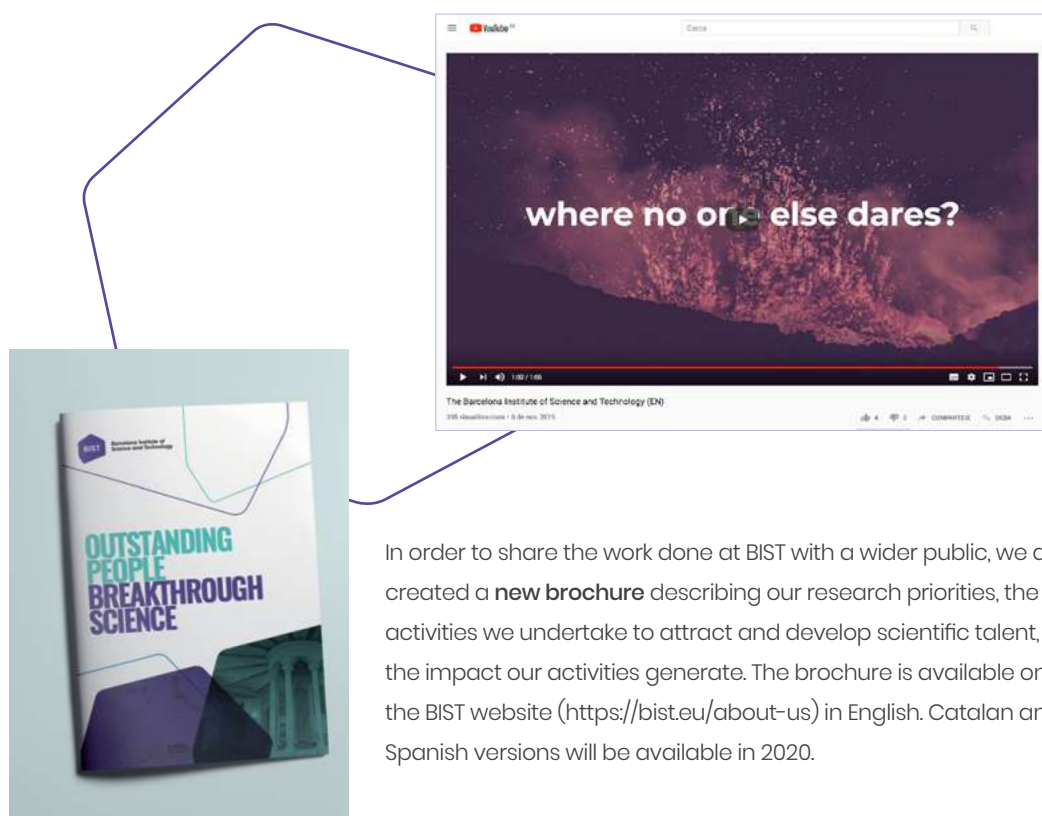
The closing ceremony of the Crazy for Physics programme, held on October 26–27, 2019, took on a particularly special format, as it was organised in Món Natura, a Fundació Catalunya–la Pedrera venue in the Pyrenees. IFAE ran an interactive workshop for participants to recreate the workings of matter and the creation of the universe using Lego pieces.



Five BIST centres (CRG, ICFO, ICIQ, ICN2, IFAE, and IRB Barcelona) also participated in a new edition of the **Barcelona International Youth Science Challenge** (BIYSC), a two-week international excellence programme of the Fundació Catalunya–La Pedrera that offers participants a world class experience working on research projects, attending scientific lectures and debates, and enjoying the company of peers with the same passions from around the world.

Communicating BIST

'What if we could improve people's everyday lives?' This sentence opens the inspiring **BIST video** produced in 2019 to present the goals we are capable of achieving by joining the talent of seven excellent research centres: *'create inexhaustible energy sources, invent new materials to save the planet, restore the vision of those who have lost it, prevent diseases in addition to curing them...'* The video was produced in three languages (English, Catalan, and Spanish) and was publicly launched on November 7 at the 2019 BIST Conference. After its release, the video was widely disseminated with a social media campaign on the BIST Twitter, Facebook, Instagram, and LinkedIn channels.

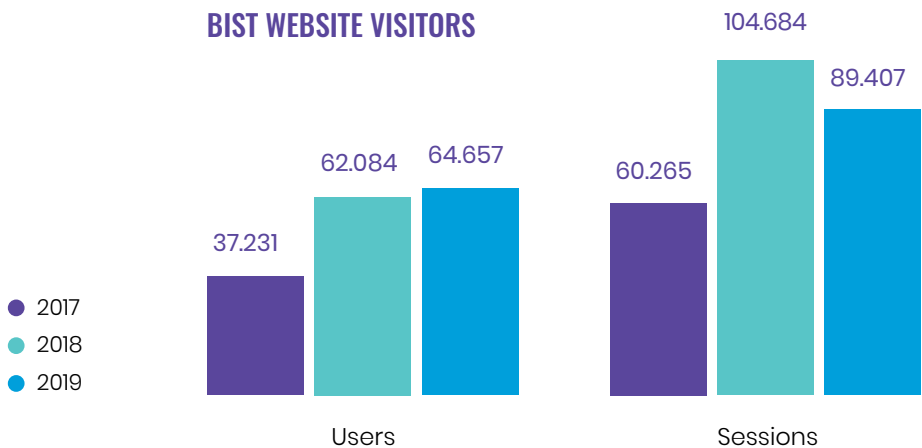


In order to share the work done at BIST with a wider public, we also created a **new brochure** describing our research priorities, the activities we undertake to attract and develop scientific talent, and the impact our activities generate. The brochure is available on the BIST website (<https://bisteu/about-us>) in English. Catalan and Spanish versions will be available in 2020.

Throughout 2019, work also continued on improving the content and functionality of the **BIST website** (<http://bist.eu>). Specifically, the job vacancies page (<https://bist.eu/jobs>) was built up to facilitate recruiting talent into the BIST centres and other research organisations, especially in Catalonia. We also improved the design of our upcoming events page to give more visibility to the activities done at BIST, its centres, and other collaborating entities. The synergy between the BIST website and the BIST social media channels was also strengthened and new audio-visual content, such as the BIST corporate video, disseminated through both.

The BIST website received 89,407 visits from a total of 64,657 users in 2019 (4.14% more than in 2018), thus consolidating the sharp increase in numbers we saw the year before. The bulk of the visits came from Spain and the United States, as well as from Asian and Middle Eastern countries (such as India, Pakistan, Iran, and Bangladesh), and from European countries (such as the United Kingdom and Germany). As we had already seen in 2018, web visits were strongly affected by the Google ad campaigns we had launched to attract students for programmes such as the BIST-UPF Master of Research and the PREBIST and PROBIST fellowships.

BIST WEBSITE VISITORS

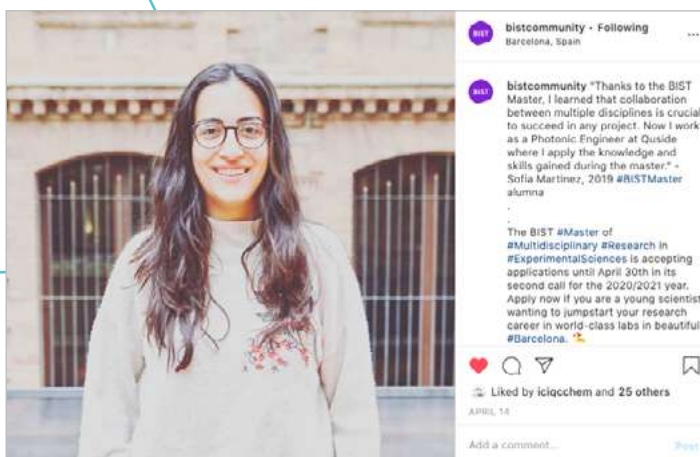
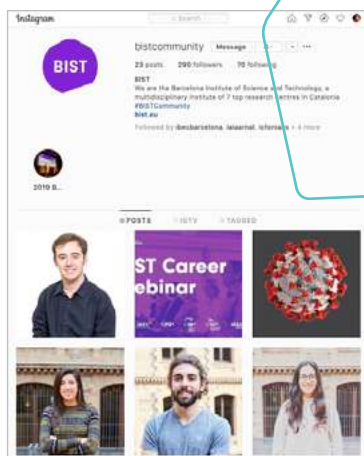


Our presence on **social media** also continued to grow steadily, both in the number of new followers on our various channels, and because we created a new BIST profile. Our **Instagram** account, which is one of the most popular platforms among younger audiences, was created in late 2019, and an active presence was maintained on Twitter, Facebook, LinkedIn and YouTube.

As of December 31, 2019, BIST had 3,454 followers on **Twitter**, a thousand more than on the same date in 2018. This is BIST's most popular channel. Communications through this network generated 532,163 impressions and more than 3,900 interactions (with a 0.8% engagement rate).

On **LinkedIn**, BIST gained 626 new followers in 2019, bringing the total to 1,623. The institute's LinkedIn page received a total of 2,355 visits, from 1,026 unique users, from 165 locations on five continents, 40% of whom were research and education professionals.

On **Facebook**, the number of BIST followers is lower (it increased from 87 to 153 followers in 2019), but communications through this network reached 9,150 users, with a growing increase over the year (from 715 in the first quarter to 4,850 in the last quarter), thanks to a language diversification strategy.



Regular contact with the **media** was also maintained in 2019. Throughout the year, press releases were sent out about various BIST activities: the 100tífiques meet-up, the BIST Ignite Grants and the 2019 BIST Ignite Awards, the BIST Statement on the Climate Crisis, and the 2019 BIST Conference, among others. We also arranged for several interviews and the publication of opinion pieces from our President, Prof. Andreu Mas-Colell, and our Director General, Gabby Silberman. Work was also done to prepare for a TV show about the THEIA project (2018 BIST Ignite Award).

The 100tífiques meet-up, held on February 7 as part of the Barcelona City & Science Biennial, had a massive public impact and received extensive coverage in media such as La Vanguardia, El Periódico, Ara, TV3, EFE, Europa Press, among others.

100 dones científiques per fomentar la ciència entre les nenes

CLARA LÓPEZ
BARCELONA

La Biennial Ciutat i Ciència de Barcelona s'estrena amb la iniciativa 100tífiques, un conjunt de xerrades per reforçar el paper de la dona científica com a referent i fomentar la vocació per la ciència entre les nenes. L'activitat, que s'organitza amb motiu del Dia Internacional de la Dona i la Nena Científica, portarà per primera vegada més d'un centenar de dones del món de la ciència i la tecnologia a 100 escoles catalanes simultàniament.

Les investigadores que participen en la iniciativa es van reunir ahir al Parc Científic de Barcelona en un acte formatiu organitzat per la Barcelona Institute of Science



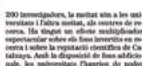
Les participants en la iniciativa es van reunir ahir en un acte formatiu. AJUNTAMENT DE BARCELONA

and Technology (BIST). L'alcaldeessa, Ada Colau, encarregada d'inaugurar l'acte, va remarcar el paper "estratègic" de les dones científiques en un "moment de canvi democràtic". "Necessitem que vagin a les escoles", va reclamar, i va demanar "que les nenes puguin veure i conèixer la seva feina i veure-s'hi reflectides".

Des del BIST, la cap de programes acadèmics i eficiència organitzativa, Núria Bayó, va defensar la importància de promocionar el lideratge femení en aquestes disciplines com a "motor per fer avançar la ciència".

Les xerrades s'inauguraran dilluns que ve amb la conferència d'Ada E. Yonath, premi Nobel de química del 2009, però no seran obertes al públic.

In order to **more accurately and effectively monitor BIST media impacts** both locally and internationally, the Communications Working Group agreed to establish a joint clipping service that would be shared among the seven BIST centres, allowing them to share information about their media presence and reducing workloads and costs. The platform has been available for use by all BIST centres since April 2019.



disfrazar en el marco d'una programació de desenvolupament extern. En finalitat, Per exemple, els ajuts de desenvolupament extern de la Comissió Europea, catalitzats sota supervisió al voltant dels 200 milions d'euros. Amb el 50% d'aquests se quantifica en tot plaçador l'evolució de la universitat. No prevejo pas augmentar les matriculacions en 1980. Però s'espera reduir la despesa en 1981 i 1982. És la meua opinió, no hi justifico prou bones raons: els ciutadans subrepticiu ara les paguen, que com tenim un sistema de tarificació social on el pagament depèn de la renda, són els que ja han pagat pagat. I en canvi però, després una reducció del 20 per cent dels ajuts que ara es li suggereixi.

Finalment, i des de la perspectiva dels centres de recerca —la situació econòmica dels quals és gairebé prou crítica—, els ajuts de desenvolupament extern són una realitat universitatària positiva. Com a exemple: la possibilitat d'efectes cooperatius d'activitats i centres de recerca pot afegir un elevat significat de compensació a la política de construcció tecnològica.

«Somos, el mismo tiempo», recuerda, «observaciones privilegiadas, pero también que recibimos una información que nos permite plantear. Por eso nos sentimos obligados a proteger la naturaleza y a hacer una declaración pública».

Expanding BIST Institutional Relations

The Barcelona Institute of Science and Technology understands that networking and institutional collaboration at all levels are essential elements for continuing to solve the great social challenges we face. We believe science professionals can make great contributions in areas such as education, business, public policy, or communication with citizens. For this reason, for yet another year, we worked hard to build a solid network of relationships with social entities, public institutions, and companies in 2019.

In line with this spirit, we have actively participated in the definition process of the **National Agreement for a Knowledge-based Society** (PN@SC: Pacte Nacional per a la Societat del Coneixement in Catalan). Members of the BIST Core Team participated in the various debates that were organised, and Professor Andreu Mas-Colell, President of BIST, along with Professor Rolf Tarrach, Member of the BIST Board of Trustees, joined the Advisory Council of PN@SC in October 2019. The PN@SC was established to create a reference framework for future policies in the areas of research and innovation.





FACTS & FIGURES



PEOPLE

2,488

BIST COMMUNITY

42%

International

45%

Women

173

Principal Investigators (PIs)

556

Postdoctoral Researchers

670

PhD Students

10

BIST Core Team



OUTREACH

434

OUTREACH ACTIVITIES

63,787

PEOPLE REACHED



PUBLICATIONS

1,355



NATURE INDEX (November 2019)

GLOBAL

#1

#2

#3

#4

#5

#6

...

#127

Chinese Academy of Sciences

Harvard University

Max Planck Society

French National Centre for Scientific Research

Stanford University

Massachusetts Institute of Technology

Barcelona Institute of Science and Technology

EUROPE

#1

#2

#3

#4

#5

#6

...

#27

Max Planck Society

French National Centre for Scientific Research

Helmholtz Association of German Research Centres

University of Oxford

University of Cambridge

Swiss Federal Institute of Technology Zurich

Barcelona Institute of Science and Technology



INNOVATION

30

ACTIVE SPINOFF
COMPANIES
(AS OF DECEMBER 2019)

78

NEW PATENT
APPLICATIONS



ERC GRANTS

133

TOTAL GRANTS
TO BIST RESEARCHERS
(2007-2019)

17

NEW ERC GRANTS



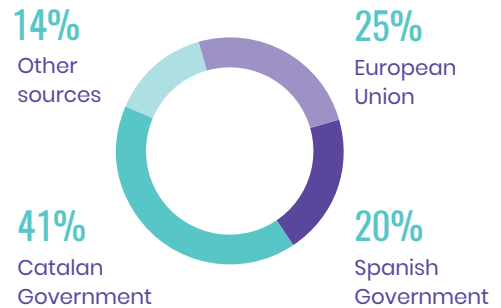
FUNDING

135M €

BIST & BIST CENTRES
BUDGET

3.1M €

BIST BUDGET



Sources

13%

Catalan
Government
400,000 €

7%

EU Cofund
228,200 €

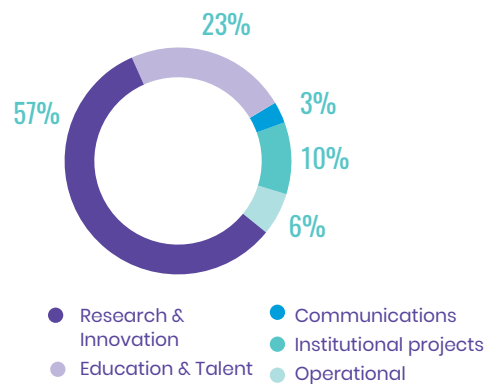
80%

Private*
2,506,750 €

- "la Caixa" Foundation
- Banc Sabadell Foundation
- FemCat Foundation
- Cellex Foundation
- Catalunya-La Pedrera Foundation

**Including yearly and extraordinary contributions*

Activities



BIST CENTRES



MEMBERS OF THE BOARD OF TRUSTEES

