




Barcelona Institute of
Science and Technology

BIST ANNUAL REPORT 2020



A large teal geometric shape, resembling a stylized house or a mountain peak, occupies the bottom half of the page. It has a flat base and a pointed top, with a small notch on the right side.

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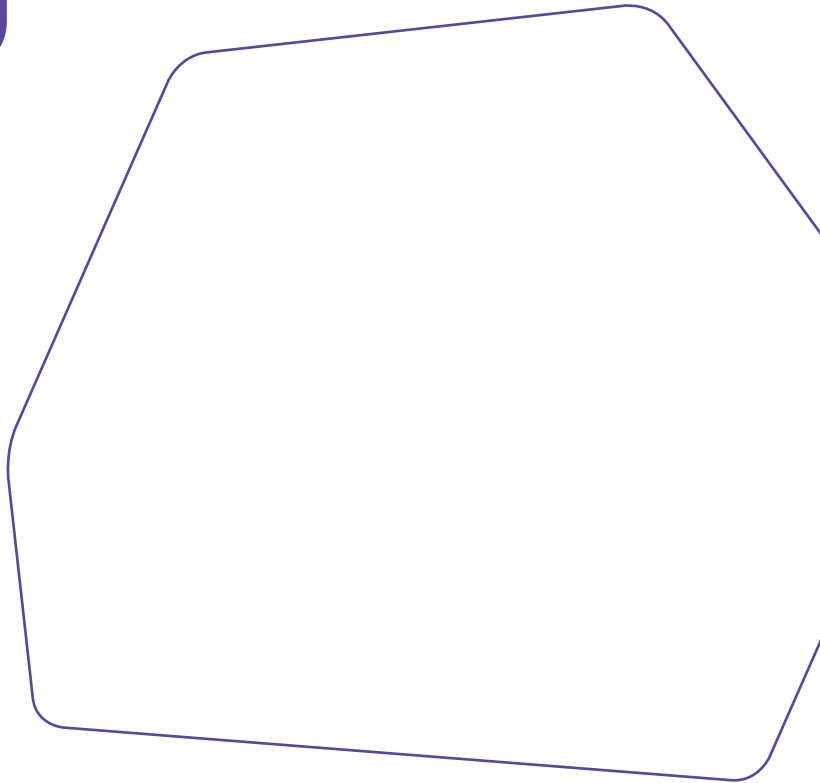
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Barcelona Institute of
Science and Technology

BIST ANNUAL REPORT 2020



BIST CENTRES



INSTITUTIONAL MEMBERS OF THE BOARD OF TRUSTEES



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FOREWORD





Five years of accomplishments

ANDREU MAS-COLELL

Chair of the Board of Trustees

BIST, in its broadest scope, is constituted by the grouping of seven research centres from the Catalan CERCA system. It was founded in January 2015. Since then, these centres have demonstrated a strong research performance, evidenced by conventional academic metrics (over 6.700 papers published, 71 ERC grants received) as well as by their innovation activities, exemplified by the 21 spin-offs launched in this period. All this while we have also gained cohesiveness and we are now a well-established reality in the scientific landscape of Catalonia, Spain and beyond. It is a reality informed by a spirit of excellence and of full cooperation with the many agents (universities, CSIC centres, technological centres, knowledge-oriented firms, etc.) that together compose a vibrant research and innovation landscape, of which we are proud to be part.

Within the narrower scope of BIST, the foundation that embodies the collaboration of the seven centres, we started our journey by setting up a five-year strategic plan running through 2020, with clear and concrete objectives. It has guided our efforts

during these years, and we are satisfied with our degree of accomplishment:

1.- First and foremost we set goals in the research area, focused on microscopy, chemical biology, graphene, and big data, as well as on fostering collaborative projects among researchers from our member centres. There have been advances in all fronts. In particular, let me mention the microscopy collaborative initiative that, with EU support, has culminated with an Advanced Microscopy Hub being installed at the Alba Synchrotron (with two powerful instruments, one for materials, the other for biology); the chemical biology programme that, with the support of "la Caixa" Foundation, has launched two groups, one at IRB, the other at IBEC; the impulse, with EU support, to the constitution of a GraphCAT community; and the BIST Ignite programme that has fostered the development of 23 collaborative projects, some of which hold substantive promise of bringing disruptive innovations to the market.

2.- As importantly, ambitious goals were set in the education and talent development area, aimed at covering all the steps of a researcher career. This academic year we are completing the fourth edition of the Master of Multidisciplinary Research in Experimental Science, in collaboration with UPF. We have also set up the BIST Dolors Aleu Graduate Centre as its academic vehicle. We see as a fundamental mission of BIST not only the attraction of talent (which we have pursued vigorously through pre-doc and post-doc grants and fellowships, supported by the EU and private foundations) but also paying attention to the follow-up concerns associated with career development. In particular, we have put in place a coherent and extensive body of training courses (Leadership in Action, To the Mothers of Science, etc.) aimed at strengthening the career prospects of our researchers, be they in research proper or in strategically related sectors (education, business and entrepreneurship, research

management, public policy, social engagement, consulting, communication, etc.).

What we have accomplished owes much to many people and institutions: the Board, the team at the Foundation, the many members of the BIST community, etc. Let me however put on the record three special expressions of gratitude. First, to the inaugural members of BIST Friends: Fundació Bosch Aymerich, Fundació Cellex, "la Caixa" Foundation, and Fundació Joan Ribas Araquistain. Second, to the founding members that have left the board in 2020 at the end of their terms: "la Caixa" Foundation and Professor Sergi Verdú. And third, to the members of the team who have accompanied us for part of our journey and have since moved on to face new professional challenges within and outside BIST: Montserrat Vendrell, Miquel Pericàs, Edgar Aigner, Patricia Anguera, Elen Garcia, Eva Martí, Jenny Kliever, Margarita Navía, Donna Ramirez, Laia Romero, and Maria Yubero.

A final word: I have not referred to the pandemic until this point, and for a reason. While we must treat the virus with the utmost respect it is imperative it does not slow us down. We should not give the monster this satisfaction. The fact our centers have launched 8 spin-offs in 2020, the maximum ever, should serve as testimony the virus has failed.



A challenging future ahead

GABBY SILBERMAN

Director General of BIST

The year 2020 has seen us work in new ways to overcome a lockdown that lasted several months and adopt social distance measures to cope with the pandemic. Despite these challenges, BIST activity not only continued, but in some areas grew because of the virtues of online content delivery tools. The BIST community was also able to develop, despite the difficult circumstances, a new strategic plan to guide our joint efforts over the coming years and into the future.

A reflection on the immediate institutional priorities and the drafting of the 2021–2025 BIST Strategic Plan kicked off in January 2020, mobilising researchers and professionals from the various collectives within the seven BIST centres in a year-long effort. Over one hundred people, representing areas such as finance, communications, human resources, outreach, core facilities, and of course researchers, shared their insights and experience in drafting and reviewing the Plan. I want to thank all of them, once again, for their valuable contributions.

The new Strategic Plan reflects our strong determination to accomplish more impactful results through our actions. It

establishes strategic initiatives to promote collaboration in research around health, sustainability, and quantum technologies. The plan also points the way for scientists to make broader social and economic contributions, promoting business innovation and entrepreneurship, and facilitating a more active participation in key sectors such as education, public policy, social engagement, and communications.

Among the activities carried out in 2020 and included in this Annual Report, I would like to highlight three which showed significant progress this year and represent foundational steps for key BIST programmes.

I start with the BIST Global Science programme, designed to prepare researchers to successfully pursue careers in both scientific leadership and positions of responsibility in other strategic sectors, such as education, business, communications, and public administration. Throughout the year we sought partners to expand training offerings and opportunities for hands-on experience in these diverse settings.

Second, in July 2020 we launched an international architecture competition to select the architects to design the new BIST building in the Antic Mercat del Peix. This new space will become a reference in personalised medicine, a key part of our strategic research initiative for health. At the close of this report, the jury is evaluating proposals from five finalists to select the winning team, with construction of the building scheduled to begin in 2022.

Finally, and towards the end of the year, we signed an agreement with the Department of Education of the Generalitat to frame the collaboration of BIST and the Department in the newly created STEAM education reference centre, the Angeleta Ferrer High School in Barcelona, which will open its doors to students in September 2021.

These are three activities, just three seeds, but their fruits will grow in the coming years, for the benefit not only of science and scientists, but of society as a whole.

ABOUT BIST

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Strengthening BIST Community collaborative work

The Barcelona Institute of Science and Technology (BIST) is a leading institution of multidisciplinary research encompassing 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)**

Twenty-twenty marked the 5th anniversary of the founding of BIST. This has led us to take stock of the achievements we have made over this time, and to reflect on how we can enhance collaboration within the BIST Community in order to increase the impact of our work.

The result has been a new BIST Strategic Plan, which covers the years 2021 to 2025, and is articulated around four axes. First, we will take our collaborative research further through three

big initiatives in: science and technology for health, energy and environmental sustainability, and quantum physics and its technological applications. Second, we will boost our training and career development programmes for researchers, seeking to widen their contribution to society, as scientific leaders but also as key players in other strategic sectors— from education to public policy or business. Third, we will work actively to engage more and more citizens in science, creating new and more participative channels and activities, while expanding the recognition of BIST contributions. And fourth, we will put in place new tools and programmes to capture more resources for research and innovation.

The new BIST Strategic Plan is a roadmap for collaboration within and outside the BIST Community. We are 2,500 people working together, and working alongside hundreds of entities, thousands of people all over the world, to make science and its impact on society grow.

It is a journey we started five years ago. We invite you to see in the following pages the steps we took in 2020.

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, and contribute to solutions for health, 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: Renewable Energy and Sustainable Catalytic Processes. Research groups work on computational chemistry, CO₂ recycling, renewable fuels, sustainable catalysis and artificial photosynthesis.



CATALAN INSTITUTE OF NANOSCIENCE AND NANOTECHNOLOGY

ICN2's research explores new frontiers of knowledge at the nanoscale and brings value to society in the form of new understanding, capabilities, innovation and the next generations of researchers. The ICN2 community includes almost 300 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 28 research groups whose major research challenges are cancer and ageing.

BIST Board of Trustees



The annual meeting of the BIST Board of Trustees was exceptionally held online because of the confinement due to the coronavirus pandemic.

During 2020 there have been various changes in the composition of the BIST Board of Trustees. First, there was a replacement in the direction of ICIQ, where Prof Emilio Palomares succeeded Prof Miquel Pericàs at the head of the centre. In September, the changes in the Catalan government were reflected in our Board with the incorporation of the new Minister of Business and Knowledge, Hble. Sr. Ramon Tremosa, succeeding Hble. Mrs. Àngels Chacón. At the end of the year, “la Caixa” Foundation and Prof Sergi Verdú left the Board of Trustees, and Mr David Nogareda was replaced by Mr. Oriol Guixà representing FemCat Foundation.

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 Emilio Palomares

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. Sr. Ramon Tremosa

*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 2020

BIST activities depend on the collaboration of its seven centres and are organised into 12 working groups that are focused on diverse areas: research, education and talent, knowledge transfer and innovation, communication, infrastructures, and management. The BIST

working groups, which are coordinated and motivated by people from the BIST core team, made a special effort throughout 2020 to maintain their regular meetings virtually and to create new proposals to overcome the impact of the pandemic on BIST programmes.

THE BIST CORE TEAM



Front row, left to right: **Núria Bayó**, Head of Academic Programmes & Organizational Effectiveness, **Clara Barreneche**, Head of Innovation & Business Development, **Óscar Gimeno**, General Manager, **Míriam Navarro**, Academic Officer, and **Maria Yubero**, International Programmes Manager. *Back row, left*

to right: **Laura Nieto**, Administrative Assistant, **Àlex Gonzalez**, Head of Institutional Relations, **Gabby Silberman**, Director General, **Adela Farré**, Head of Communications & Branding, and **Marta Llorens**, Communications Officer.

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)



EMILIO PALOMARES

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 of the Barcelona Institute of Science and Technology (BIST)

BIST WORKING GROUPS

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

The activities carried out by BIST in 2020 would not have been possible without the commitment and the contribution of the more than 100 members that make up our working groups.

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
Gabby Silberman, BIST

MANAGERS WG

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

INFRASTRUCTURE WG

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

COMMUNICATIONS WG

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

CHEMICAL BIOLOGY PWG

Pau Gorostiza, IBEC
Pau Ballester, ICIQ
Daniel Ruiz, ICN2
Ernest Giralt, IRB Barcelona

KNOWLEDGE AND TECH. TRANSFER WG

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

GRAPHENE PWG

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

ACADEMIC WG

Luciano Di Croce, CRG
Pau Gorostiza, IBEC
Robert Sewell, ICFO
Mónica H. Pérez-Temprano, ICIQ
Arben Merkoci, ICN2
Rafel Escribano, IFAE
Roger Gomis, IRB Barcelona
Núria Bayó, BIST
Míriam Navarro, BIST

ADVANCED OPTICAL MICROSCOPY PWG

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

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

BIG DATA PWG

Roderic Guigó, CRG
Paul Vershure, 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

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
Maria Yubero, BIST

*WG = Working Group
PWG = Programme Working Group
TF = Task Force*

RESEARCH & INNOVATION

The background of the slide features a series of overlapping, rounded rectangular outlines in a light cream color. These shapes are arranged in a staggered, descending pattern from the top left towards the bottom right, creating a sense of depth and movement. The overall color palette is a soft, muted lavender.

Three initiatives to take our research further

Our research community encompasses almost 2,000 people, including 177 principal investigators, 566 postdoctoral researchers, 679 PhD students, 107 master students, over 300 core facilities and lab technicians, engineers and research assistants, as well as visiting researchers. They have been working tirelessly at the seven BIST centres throughout 2020, advancing towards their trailblazing goals and adding new substantial challenges, including those that arose from the need to fight COVID-19 (see the following section).

The excellent work done by BIST researchers has been recognised, once more, by the European Research Council, which in 2020 awarded eight grants, worth more than 15M€ in total, to as many research groups. **Manuel Irimia**, ICREA Professor at CRG, **Núria Montserrat**, ICREA Professor at IBEC, as well as **Darrick Chang**, **Gerasimos Konstantatos**, and **Leticia Tarruell**, all three ICREA Professors at ICFO, were awarded an ERC Consolidator Grant each. Two CRG groups, led by ICREA Professors **Thomas Surrey** and **Vivek Malhotra**, are part of two consortia awarded ERC Synergy Grants worth 10M€ each. Finally, **Manuel Serrano**, ICREA Professor at IRB Barcelona, was awarded with an ERC Proof of Concept Grant.

About 50 group leaders and senior researchers took part in the meetings and internal

discussions that allowed us to define the **three BIST Research Initiatives** included in the new 2021-2025 BIST Strategic Plan, which will boost our collaborative research work in the years to come.

The three initiatives are focused on: **Science and Technology for Health** — encompassing such research lines as Healthy Aging, Precision Medicine, and New Approaches to Infectious Diseases —, **Energy and Environmental Sustainability** — including Nano and Bio-engineering for Pollution Remediation, Clean Energy, and Sustainable Production —, and **Quantum Physics and its Technological Applications** — which covers Quantum Materials and Topological Matter, Quantum Methods in Biology, Quantum Technology and Advanced Experimental Methods for Sensing and Detection, Quantum Communications, and Artificial Intelligence and Big Data.

These initiatives will take advantage of the confluence of a wide range of research, technology, and innovation capacities at the BIST centres, from genomics, bioinformatics, cellular and molecular biology, chemical biology, and bioengineering, to sustainable catalysis, artificial photosynthesis, nanotechnology, advanced materials, photonics, and quantum computing, among others. This multidisciplinary array, together with extensive knowledge, state-of-the-art

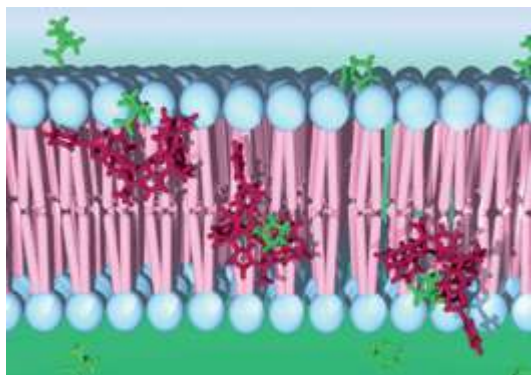
tools, and the collaborative environment stimulated by BIST, will allow our researchers to successfully reach the most ambitious goals and make valuable contributions to the progress of science.

The following are some examples of collaborative projects developed by BIST researchers in 2020 in the areas covered by the three BIST Research Initiatives

SCIENCE AND TECHNOLOGY FOR HEALTH

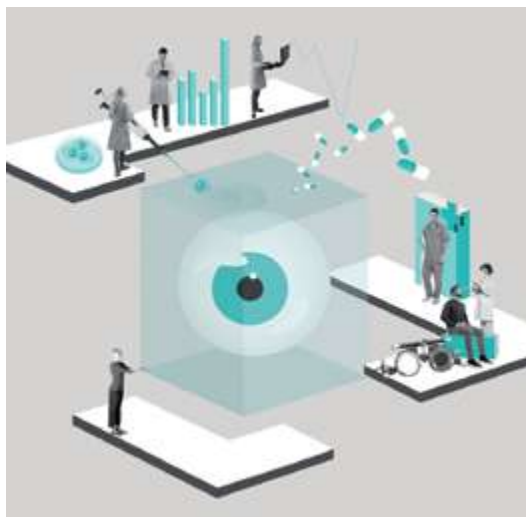
IRB Barcelona and ICIQ studying cell metabolism together

In October 2020, *Chem* published a paper showing how a synthetic carrier calix[4]pyrrole cavitand can transport amino acids across liposomes and cell membranes, bringing future therapies for diseases such as cancer or cystic fibrosis a step closer to reality. This is a relevant result of the BIST Ignite project CALIX4TRANS carried out by researchers from ICIQ and IRB Barcelona.



CRG and IBEC bring eyes back to life from deceased body donors

An international research consortium led by CRG and including IBEC announced in December 2020 that it is developing a device to resuscitate eyes from deceased body donors and keep them healthy for at least one month, greatly improving clinical research possibilities. The device, codenamed ECaBox, has been awarded 3.5 million euros by the European Union's Future and Emerging Technologies Open Research Programme.



ENERGY AND ENVIRONMENTAL SUSTAINABILITY

ICIQ and ICFO mimic photosynthesis to fight climate change

In April 2020, the LICROX project, which will implement a new type of photoelectrochemical cell (PEC) that mimics photosynthesis, received a three million euro grant from the European Commission. PECs have the potential to become efficient and cost-effective technologies for artificial photosynthesis,

leading to one of the most efficient ways of fighting climate change.



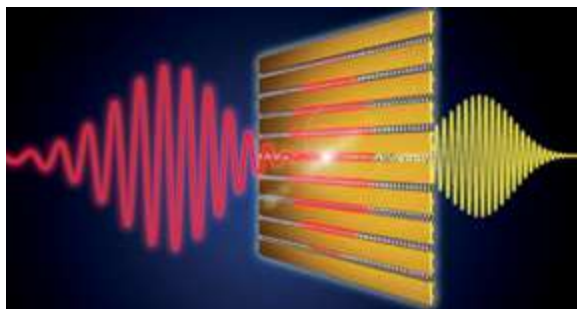
QUANTUM PHYSICS AND ITS TECHNOLOGICAL APPLICATIONS

IFAE develops new quantum computing technologies

AVaQus, an IFAE coordinated project, aims to overcome the limitations of current annealing devices by applying the latest developments in superconducting quantum circuits. Funded by a European Commission FET-Open grant, AVaQus is the first European-funded large-scale project in quantum annealing, and will consolidate quantum annealing hardware as a research field in Europe, and potentially as a future European quantum technology.

ICN2 and ICFO open the road for terahertz nonlinear photonic applications

In December 2020, an ACSNano paper demonstrated that a hybrid material consisting of a single layer of graphene and a metallic grating structure is an excellent candidate for commercial applications in which efficient nonlinear conversion of (invisible) terahertz light is required. The work includes researchers from ICN2 and ICFO, and opens the path for terahertz nonlinear photonic applications such as new communications technologies.



Joint programmes: Microscopy, New Materials, Chemical Biology

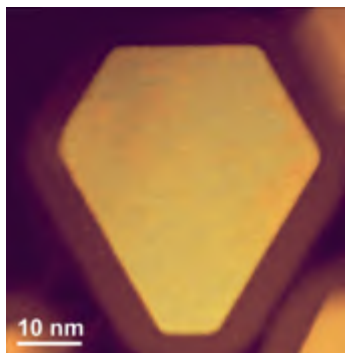
In 2020, BIST continued to foster multidisciplinary research and new collaborations within the BIST Community, reaching several major milestones within its joint programmes in microscopy, new materials, and chemical biology.

MICROSCOPY

On April 9th, 2020, the European Regional Development Fund (ERDF) announced the co-financing of **two major scientific infrastructures** in Barcelona, equipping the city with a European first-class collaborative microscopy platform. The project was first ignited by the Barcelona Institute of Science and Technology in 2016 and is the fruit of a joint effort by nine research entities. The purpose of this ERDF call was to create, build, acquire or improve shared scientific and technological equipment and platforms. Among those approved are the two proposals from Barcelona, one dedicated to materials science, valued at 4.1 million euros and led by the Catalan Institute of Nanoscience and Nanotechnology (ICN2), and another dedicated to molecular biology, valued at 1.7 million euros and headed by the Institute of Molecular Biology of Barcelona (IBMB-CSIC). The resulting acquisition and installation of advanced electron microscopy equipment at the ALBA Synchrotron will make Barcelona a **hub of excellence** in Europe for scientific collaboration in this field.

The third edition of the **BIST Symposium on Microscopy, Nanoscopy and Imaging Sciences** also took place in 2020 (on January 24th) at the Institute of Photonic Sciences (ICFO). This annual event is part of the BIST MMRES curriculum but is also

open to the wider BIST Community. The 2020 edition brought together 158 researchers from the BIST centres and other institutions.



NEW MATERIALS

The Barcelona Institute of Science and Technology is a member of **GraphCAT**, the Graphene Community of Catalonia, which set its official goals in January of 2020 and already reached several milestones over the year. GraphCAT is coordinated by the BIST centres ICN2 and ICFO and is part of RIS3CAT, the Catalan Government's regional research and innovation strategy which aims to establish Catalonia as an international reference in graphene research. The initiative is co-funded by the European Regional Development Fund (ERDF), with the support of the Secretaria d'Universitats i Recerca of the Departament d'Empresa i Coneixement of the Generalitat de Catalunya. The BIST centre IFAE is also a member, and ICIQ and IBEC are associated members, along with several other Catalan institutions and companies.

The creation of two spin-off companies, INBRAIN Neuroelectronics and QURV, is a major milestone of the GraphCAT community, and a clear indicator of its strength and potential.



INBRAIN Neuroelectronics, an ICN2 spin-off launched in 2019, develops brain implants based on graphene technology for



application in patients with Parkinson's, epilepsy, and other neurological diseases. The company received funding from Sabadell Asabys and Alta Life Sciences, as well as ICF and Finaves in 2020.

QURV, spun out from the BIST centre ICFO in 2020, has a portfolio of patent families for wide-spectrum image sensor technologies that offers mass-deployable solutions to enable enhanced computer vision applications for increasingly autonomous and intelligent new technologies.

From October 19th to 23rd, 2020, BIST, together with ICN2 and ICFO also participated in the **Graphene 2020 Conference**, this year held online, with a virtual booth dedicated to GraphCAT. The conference, the largest international meeting on new materials in the world, brought together experts to discuss recent advances in 2D materials technologies at more than 30 plenary presentations, two full days of parallel workshops, PhD student presentations, and poster sessions.



CHEMICAL BIOLOGY

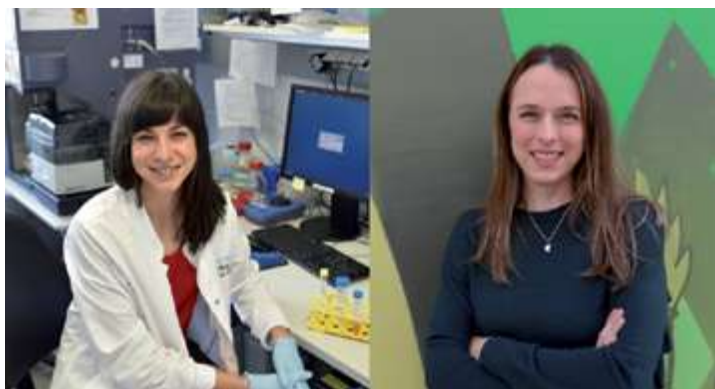
In 2020, BIST and two of its centres — IRB Barcelona and IBEC — completed a selection process for two group leaders to head two new chemical biology research groups in the BIST Community. The recruitment process was the first action of the new **“la Caixa” Foundation – BIST Chemical Biology Programme**, which officially launched in 2021 with the incorporation of the new group leaders. The aim of the programme is to further

research in chemical biology, with a focus on improving the design and production of new drugs, thereby creating for the first time a multidisciplinary hub of this discipline in Barcelona.

Dr. **Cristina Mayor-Ruiz** will head the new group at IRB Barcelona, which will work on targeted protein degradation, an innovative technique with therapeutic applications. Her group will use chemical entities (drugs) to reprogramme mechanisms that our cells naturally employ to degrade proteins. They will redirect these mechanisms towards proteins that are of therapeutic interest. Examples include the treatment of cancer, specifically pancreatic cancer, for which there is currently practically no treatment available.

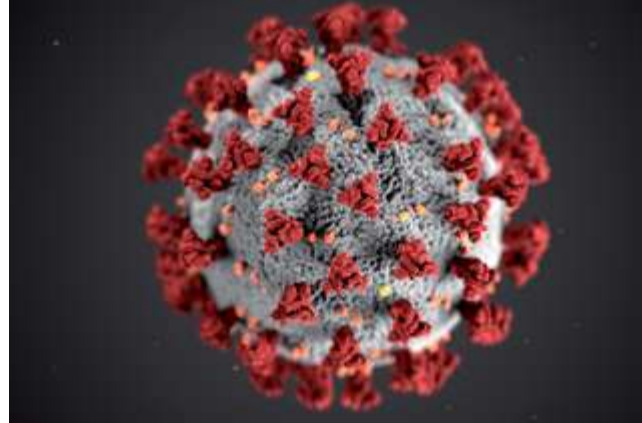
Dr. **Irene Marco-Rius** will lead the new IBEC group, focusing on developing innovative molecular imaging technologies to diagnose diseases and assess early response to treatment. Her group will look for markers of disease or drug responses before anatomical changes occur. This could include distinguishing between cancer cells and healthy cells inside the body using a magnetic resonance imaging device without any pain and without the need for a biopsy.

Dr. Marco-Rius' new position also represents a success story for the **BIST To the Mothers of Science** leadership programme. She was one of the winners of its 2020 edition, which aims to support mothers working in research as they advance in their respective fields, equipping them with the necessary tools to succeed in leadership roles.



Fighting COVID-19

BIST researchers have been fighting coronavirus and its rapid spread from the very beginning of the pandemic. They have used their know-how and talent to launch many impactful research projects in extensive international collaborations to help overcome the pandemic and to prepare ways to avoid future threats. Some of the projects launched in 2020 are described below.



CoNVat: Accelerating the detection of COVID-19

This international collaboration led by CSIC Research Professor at ICN2 **Laura Lechuga** is developing a nanodevice to detect coronavirus in just 30 minutes. Its biosensor device will also allow for the analysis of different types of coronavirus in reservoir animals such as bats, monitoring their evolution and preventing future outbreaks in humans. CoNVat is one of 17 urgent COVID-19 projects funded by the European Commission.

Kidney receptors to fight COVID-19 infection

ICREA Professor at IBEC **Núria Montserrat** and her team are part of the international MAD-CoV-2 project, which studies coronavirus infections in host cells and quickly translates the knowledge into new medicines and health protocols. The collaboration aims to better understand the role of ACE2 receptors (present in several human organs including the kidneys) in coronavirus infection, and to develop new antivirals against the virus and other diseases.



Compact devices to detect the evolution of COVID-19

Invasive mechanical ventilation (IMV), although potentially lifesaving when used in the correct cases, can also cause lung injuries. ICREA Research Professor at ICFO **Turgut Durduran** leads the international project VASCOVID which will deploy and mature a portable, non-invasive, and real-time health monitoring device to assess microvascular health in COVID-19 ICU patients, helping determine whether IMV is necessary.



Orfeu: A massive coronavirus screening service

The Generalitat de Catalunya launched the Orfeu programme in 2020, a massive coronavirus screening service to supplement the public health system's capacity for processing PCR tests. The CRG coordinated a task force with CNAG-CRG, IRB Barcelona, and IBEC to carry out more than 20,000 PCR tests as of the end of May 2020. The initiative did not need to roll out the second phase as the health system was no longer in need of the supplemental support.

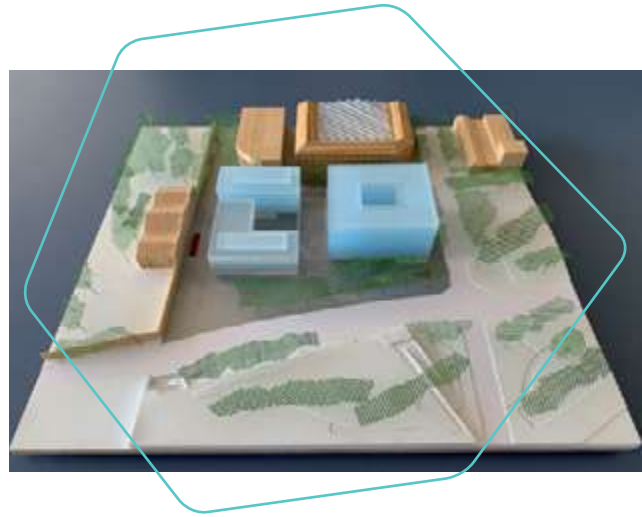
Other COVID-19 projects launched in 2020 by the BIST centres include:

- IRB Barcelona and Amazon collaborated to speed up the search for COVID-19 drugs
- A CRG-developed programme helped standardise international COVID-19 data analysis
- IFAE's Port d'Informació Científica put its computing resources at the service of COVID-19 research
- CRG researchers launched an international study on COVID-19 and Down syndrome
- IBEC contributed to creating a low-cost ventilator for areas with limited means
- IFAE worked to develop an easy-to-use technology to detect purified coronavirus RNA
- ICFO researched effective disinfection of work spaces using ultraviolet light
- IBEC studied the impact of COVID-19 confinement on mental health and well-being
- ICN2 researchers published an overview of the current diagnostic techniques for respiratory viruses including SARS-CoV-2
- CRG found ferrets, cats, and civets most susceptible to coronavirus infection after humans
- ICFO researchers illustrated how facemasks protect against the spread of COVID-19

International Architecture Competition for a New Scientific Building

In July 2020, BIST launched an international architecture competition to select a team of architects that will draft the basic project and the construction project of its new building in the Antic Mercat del Peix area, next to Parc de la Ciutadella. This was the first step of an ambitious project which aims to turn the area into a research and innovation complex focused on biomedicine, biodiversity, and planetary well-being.

More specifically, the new BIST building will be a hub for precision medicine, and will permanently host research groups from IRB Barcelona, IBEC, CRG, and ICN2, as well as occasionally accommodate researchers from other BIST centres (ICIQ, ICFO, and IFAE), and from hospitals and other scientific entities.



More than 30 national and international architecture teams participated in the first phase of the competition. In October 2020, BIST announced the five teams selected by the jury to take part in the second phase: Barozzi Veiga (Barcelona), Pich-Aguilera / 2BMFG Arquitectes / JG Ingenieros (Barcelona), Moneo Brock / Baas / Casasolo (Madrid / Barcelona), BIG + IDOM (Denmark / Spain), and Woods Bagot (Australia).

The winning team will be announced in July 2021 and construction work on the new building is scheduled to begin in 2022 and to be completed in 2024.



BIST Ignite Programme



The BIST Ignite Programme was launched in 2016 to promote multidisciplinary research through new collaborations among members of the BIST research community. Every year, a competitive call is launched to select five projects that will receive funding to jumpstart their research collaboration. Based on the results at the end of the first year of funding, two projects are selected to receive additional funding and a BIST Ignite Award.



On March 11th, the 2020 BIST Ignite Awards Ceremony was held in the Auditori La Pedrera to recognise the two winning teams of the 2020 BIST Ignite Awards, and to announce the five projects selected in the 2019 BIST Ignite Programme call.

The projects **BIOSPAD**, co-led by ICREA Prof. Sebastian Grinstein (IFAE), ICREA Prof. Turgut Durduran (ICFO), and Dr. Salvador Hidalgo (IMB-CNM), and **BIOVAC**, a collaboration between Dr. Daniel Ruiz (ICN2) and Dr. Eduard Torrents (IBEC), both received a 2020 BIST Ignite Award.

The five new collaborative projects awarded with the BIST Ignite Seeding Grant were: **NANO-GBA**, which investigates alterations in the Glucocerebrosidase enzyme (GBA) and is co-led by Silvia Muro, ICREA Prof. at IBEC, and María García-Parajo, ICREA Prof. at ICFO; **MAKI**, led by Dr. Claudio Parolo from ICN2 and Dr. Gemma Aragay from ICIQ, which is developing a new method to detect biomarkers of acute renal failure; **SensMOF**, led by Dr. Leyre

Gómez Navascués (ICN2) and ICREA Prof. José Ramón Galán-Mascarós (ICIQ), which will develop new solutions to distinguish and separate enantiomers; **2DETMIPS**, a project that explores the properties of graphene to produce a prototype sensor to detect certain particles, led by Dr. Stefano Terzo (IFAE) and Dr. Klaas-Jan Tielrooij (ICN2); and **QEE2DUP**, co-led by Dr. Antoine Reserbat-Plantey (ICFO) and Dr. César Moreno (ICN2), which will design new materials for their use in quantum computing and communications.

The event, which was the last face-to-face BIST activity before several months of confinement and online work, featured Dr. Serge Picaud from the Institut de la Vision (Paris) as keynote speaker. Dr. Picaud, a new partner of the BIST Ignite Project THEIA, now iVision, which was a 2018 BIST Ignite Award recipient, gave the talk “Restoring vision in blind patients: from dream to reality”.

On December 10, 2020, the fifth call of the BIST Ignite programme was launched. To boost the participation of postdoctoral researchers and support them in the definition of disruptive research proposals, BIST organised the **Creativity for Cross-Pollination Innovation** course, taught by Holly Blondin, which started on December 1, and continued throughout January 2021.



BIST Scientific Publications

BIST had another record year in 2020 for scientific publications, with BIST centre researchers publishing 1,403 scientific papers over the year. This brings the total number of publications indexed in the Web of Science Core Collection and Scopus to 6,389 since October 2015, when the centres first began signing all scientific publications with an affiliation to BIST, to December 2020. BIST also implemented the iMarina Information System in 2020, to better manage BIST scientific information.

The number of publications by BIST researchers have grown year over year, and BIST has reached an enviable level of scientific excellence among the most prestigious institutions in the world. According to the Science Citation Index Expanded (SCI-E) database, publications by BIST researchers from 2016 to 2020 had an average of 21.63 citations per article, and 4.02% of all articles/reviews were highly cited publications, placing BIST second in the world for these indicators after Caltech (see *Facts & Figures section*).

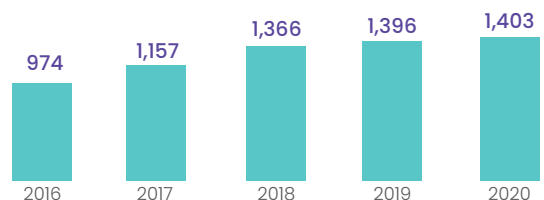
To understand the impact of BIST publications, we look at the number of citations in the Scopus database since October 2015. This database shows a cumulative 115,168 citations over 63 months, with an average of 19.3 citations per publication.

Looking at the period from 2016 to 2019, BIST publications indexed in the Web of Science Core Collection database represented 1.69% of Spanish scientific production and 6.17% of Catalan scientific production. When counting only first quartile publications, the percentages are an impressive 2.49% and 8.29%, respectively.

It is worth mentioning that an overwhelming majority of the total BIST publications are found in journals of the first quartile (Q1). In the period from 2015 to December 2020, 73.2% of the total number of publications were in Q1 journals according to Journal Citation Reports, and 83.2% as shown in the Scimago Journal Rank.

Finally, looking at internal collaboration among researchers from different BIST centres, 124 publications were identified as having co-authors from more than one BIST centre in 2020 (1.95% of the total publications).

TOTAL PUBLICATIONS



A banner year for BIST spin-offs

BIST and the BIST centres are strongly committed to innovation and knowledge transfer. In 2020, seven new spin-off companies were created by BIST researchers, bringing the total number to 40, of which 37 are currently active.

BIST spin-offs also had a record year for financing. **Ona Therapeutics**, an IRB Barcelona spin-off, raised 30 million euros in a venture capital funding round headed by Asabys Partners, with involvement from Alta Life Sciences, Ysios Capital, FundPlus, and BPI France. This is the largest private funding round ever closed for a start-up in Spain. The CRG spin-off **Pulmobiotics**, for its part, secured a two-million-euro investment from Invivo Capital. **INBRAIN Neuroelectronics**, a spin-off launched by ICN2, also received an important investment (undisclosed amount) from Sabadell Asabys, Alta Life Sciences, ICF, and Finaves, while IRB Barcelona's **Gate2Brain** secured 500,000 euros through the Botín Foundation's Mind the Gap Programme.

The IRB Barcelona spin-off **Iproteos** was also acquired by Accure Therapeutics in 2020, with an initial investment of 7.6 million euros to develop the company's product portfolio.

The new spin-offs launched in 2020 are:



- **Baretek (IFAE)**: Provides specialised microelectronics packaging services for proof of concepts, prototyping, and small productions related to particle/radiation pixel detectors.



- **Deep Detection (IFAE)**: Offers innovative industrial inspection solutions combining X-ray detection and artificial intelligence.



- **Gate2Brain (IRB Barcelona)**: Aims to improve drug delivery across biological barriers with radically innovative peptide-based patented technology.



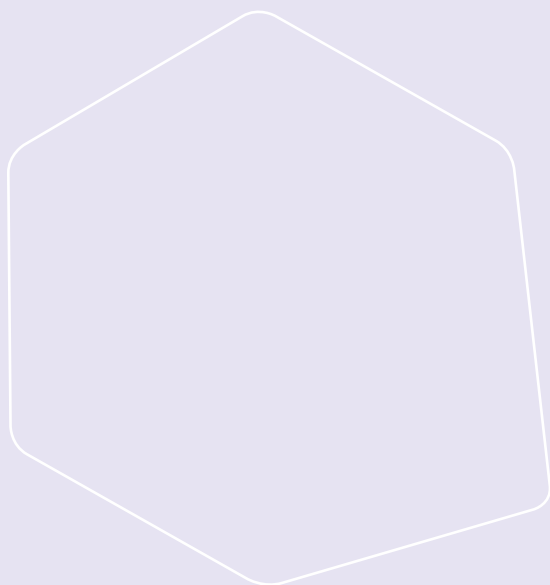
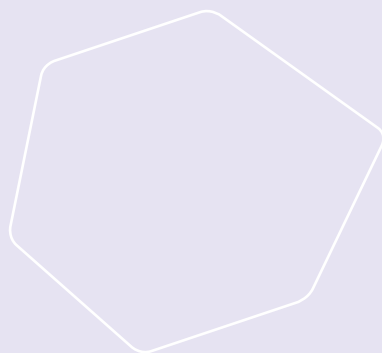



- **Pulmobiotics (CRG)**: Aims to discover and develop novel treatments and vaccines for respiratory diseases.
- **Qurv (ICFO)**: Image sensor technologies that enable enhanced computer vision applications, addressing the needs of an intelligent new world.
- **Sixsenso (ICFO)**: Aims to rapidly identify and quantify microbiological organisms in water and bio-compatible liquid samples.
- **Treellum Technologies (ICIQ)**: Has developed a photoreactor system that uses light to trigger reactions that enable otherwise inaccessible reaction pathways.

Boosting innovation through EIT Health

The Barcelona Institute of Science and Technology has been a core partner of EIT (European Institute of Technology) Health since 2018. In 2020, BIST participated in several events organized by the EIT Health consortia, further building its relationship with other EIT Health partners. In particular, BIST participated in the **EIT Health Summit Series 2020**, an interactive virtual event designed to explore the most critical topics in healthcare innovation. BIST also held meetings with industry and academic partners to analyse potential joint proposals at an **EIT Health Matchmaking Event** in February in Berlin. Finally, members of the BIST Community attended the **EIT Health Virtual Matchmaking Event** in November, where they met with strategic potential partners from among the 500 attendees representing more than 150 EIT Health partners, positioning BIST as a key provider of science and technology.

EDUCATION & TALENT



BIST Master of Multidisciplinary Research



The Education and Talent Programmes of the Barcelona Institute of Science and Technology cover all stages of the scientific career, from courses for undergraduate students (like the **Master of Multidisciplinary Research in Experimental Sciences**, MMRES) to professional workshops and coaching for researchers interested in transitioning to other sectors such as education, business, or public policy, which fall under the **BIST Global Science** programme. Between these two extremes lies a wide range of BIST training courses, designed to help researchers develop their scientific careers and make full use of their capabilities.

In July 2020, twenty-two students graduated from the MMRES class of 2019/2020, but not before overcoming several complicated months due to the coronavirus pandemic. Despite difficulties accessing laboratories to carry out their work, the students managed to successfully complete their major and minor research projects. On September 18, the **2020 MMRES Annual Ceremony** took place (online) to celebrate the

graduation of the 2019/2020 cohort and to welcome the 22 students of the 2020/2021 class.

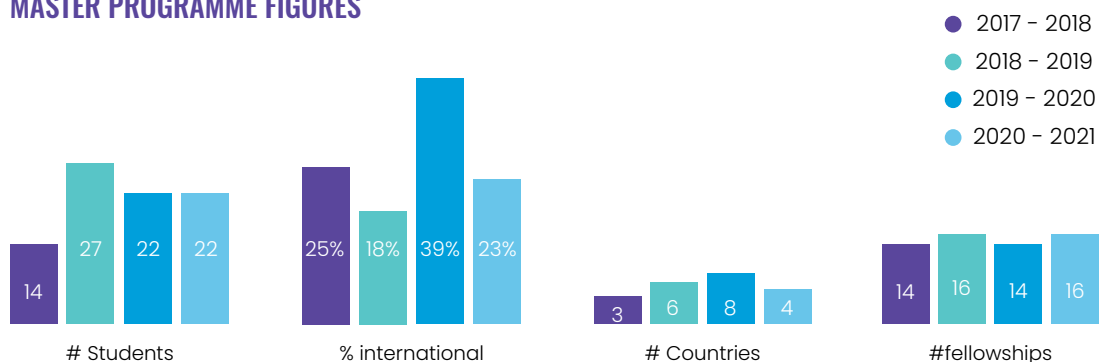
BIST Director General Gabby Silberman attended the event, along with MMRES Co-Directors Prof. Robert Sewell and Prof. Roderic Guigó, and MMRES Coordinators Dr. Núria Bayó and Dr. Rubén Vicente. Dr. Renée Beekman, Group Leader at CRG, was the event's keynote speaker.

In September 2020, coinciding with the beginning of the course, a new website for the BIST Master of Research (mmres.bist.eu) was also launched.

As of the 2020/2021 academic year, the **BIST Dolors Aleu Graduate Centre (DAGC)**, created in 2019 and accredited by Pompeu Fabra University (UPF), is fully responsible for the MMRES academic management. BIST has equipped itself with the technical tools, internal processes, and governance structures necessary for the proper functioning of the BIST DAGC. BIST Director General Prof. Gabby Silberman, is Director of the BIST DAGC, and former IRB Barcelona Director Prof. Joan Guinovart has been named the centre's Academic Director.

The MMRES programme includes various activities open to the BIST Community and the general public. In 2020, BIST organised the third edition of the BIST Symposium on Microscopy, Nanoscopy and Imaging Sciences, and two new series of BIST Colloquia.

MASTER PROGRAMME FIGURES



2020 BIST Symposium on Microscopy, Nanoscopy and Imaging Sciences



The third edition of the BIST Symposium on Microscopy, Nanoscopy and Imaging Sciences took place on January 24, 2020, at the Institute of Photonic Sciences (ICFO). The event brought together 158 researchers, mostly from the BIST centres, including the MMRES students.



The programme included presentations on the state-of-the-art microscopy techniques by several international experts, including **Mathieu Kociak** (CNRS-Univ. Paris Sud), **Rafal Dunin-Borkowski** (ER-C Jülich), **Sonia Antoranz Contera** (Oxford University), **Florian Albrecht** (IBM Zurich), **Daniel Guberman** (INFN Pisa), **Jonas Ries** (EMBL), **Sandrine Lévêque-Fort** (Université Paris-Sud), **Emilio Gualda** (ICFO), and **Alba Diz-Muñoz** (EMBL). The 22 master's students from the 2019/2020 class also gave poster presentations.

2020 BIST Colloquium series

In 2020, BIST organised two series of colloquia, one in spring and one in fall. These gave MMRES students and other researchers from within and outside the BIST Community the chance to learn first-hand from outstanding scientists from all over the world. Due to the COVID-19 pandemic, most sessions were held online, and some needed to be cancelled or rescheduled.



*Prof. Günther Dissertori
Particle Physics and
Astrophysics (ETH Zürich)*

The spring series included a talk by Prof. **Günther Dissertori** from the Institute for Particle Physics and Astrophysics (ETH Zürich) on February 3, 2020. He gave an introduction to the physics studied at CERN's Large Hadron Collider, focusing in particular on the Higgs boson discovery. Prof. Dissertori was also invited by the Fundació Catalunya La Pedrera to give a talk as part of its outreach series *Ciència Afterwork*, which took place the same day in front of a full auditorium at La Pedrera.

Prof. **Maria José Alonso** from the Center for Research in Molecular Medicine and Chronic Diseases (CIMUS) in Santiago de Compostela (Galicia, Spain), gave the second colloquium of the series on March 2. The series also included a talk by Dr. **Andrés Hidalgo** of the Spanish National Center for Cardiovascular Research (CNIC), who presented on May 18. The colloquium by Prof. **Viola Vogel** (Laboratory of Applied Mechanobiology –ETH Zurich), was postponed from March 31 until the fall (October 19), while the talk by Prof. **Michaela Frye** from the German Cancer Research Center (DKFZ), scheduled for July 3, unfortunately needed to be cancelled.



*Prof. Viola Vogel
(Laboratory of Applied
Mechanobiology –ETH Zurich)*

The Fall Colloquium Series included eight speakers (including the above mentioned Prof. Viola Vogel). Prof. **Ana Pombo** from the Max-Delbrück Centre for Molecular Medicine (Berlin, Germany) was invited by CRG and presented on September 28. On October 5, Prof. **Sarah-Maria Fendt** (Katholieke Universiteit Leuven,



*Dr. Georgia Theano Papadakis
(Stanford University, USA)*

Belgium), who was invited by IRB Barcelona, gave her talk. DCEXS invited Prof. **Fabrizio d'Adda** (FIRC Institute of Molecular Oncology, Milano, Italy), who presented on October 21. Prof. **Raffaella Buonsanti** from EPFL (École Polytechnique Fédérale de Lausanne, Switzerland), was invited by ICIQ and gave her colloquium on October 26. ICN2 for its part invited Prof. **Oscar Franco** (Institute of Social and Preventive Medicine, ISPM, Bern, Switzerland), for the November 2 colloquium. Finally, Dr. **Georgia Theano Papadakis** (Stanford University, USA), was invited by ICFO for November 9, and Prof. **Rogério Rosenfeld** (Universidade Estadual Paulista, Sao Paulo, Brasil), was invited by IFAE to give the November 16 colloquium.

Altogether the 2020 Colloquium Series gathered about 300 people, in addition to the MMRES students.

BIST Global Science

A large number of talented postdoctoral researchers will not get permanent positions in academia as group leaders, senior researchers, or university professors, and after some years of hard work in the lab will consider reorienting their careers to other sectors.

The BIST Global Science Programme encompasses the training courses, workshops, and internships we offer, which focus on helping researchers transition successfully to strategic sectors including **education, business and entrepreneurship**, and **public policy and social engagement**. Some of these activities are organised by BIST, like the 2020 **Career Webinar** series held between April and June of 2020, or the annual **BIST-Esade From Science to Business** course. Other times we partner with institutions to let BIST researchers taste alternative professional pathways, like in the **Amgen TransferCiència** programme.

Education

On January 30, 2020, about 150 female scientists participated in the **100tífiques meet-up**, which took place in the PRBB Auditorium. In addition to publicly recognising the contribution of women to science (see section *Empowering Women Scientists*), the objectives of the event were to train participants in effective ways to bring science to the classroom, and to discuss how to bring researchers closer to the education sector to inspire vocations.



On June 22, BIST organised the Career Webinar ***Getting ready to give your science a social impact: Becoming a Science Teacher***. Speakers included Dr. Paola Chiara Bartoccioni, postdoctoral researcher at IRB Barcelona, Dr. Víctor Lopez Simó, researcher, education expert, and member of CRECIM, Dr. Victòria Salgado, researcher and teacher, and Dr. Mar Carrió Llach, biologist, professor, DCEXS-UPF researcher, and member of the Health Science Education Research Group.

In September 2020, BIST collaborated in the launch of **Amgen TransferCiència**, an internship programme designed to bring science closer to society by giving its participants the skills to teach science to secondary school students. The programme is an initiative of the Fundació Catalana per a la Recerca i la Innovació (FCRI) and the company Amgen. Its first edition had the collaboration of several educational institutions including Grup de Recerca Educativa en Ciències de la Salut (GRECS-UPF), Robotix Balears, University of Valencia, and BIST. BIST selected 15 researchers from the BIST centres to join the other 15 programme participants.

Two Career Webinars organised in 2020 were focused on potential transitions to industry: *Getting ready to bring your science into industry: Becoming a Scientific Project Manager or a Business Developer* (April 24) and *Getting ready to bring your science into industry: Becoming a Scientific Expert in Clinical Trials Management* (May 8).

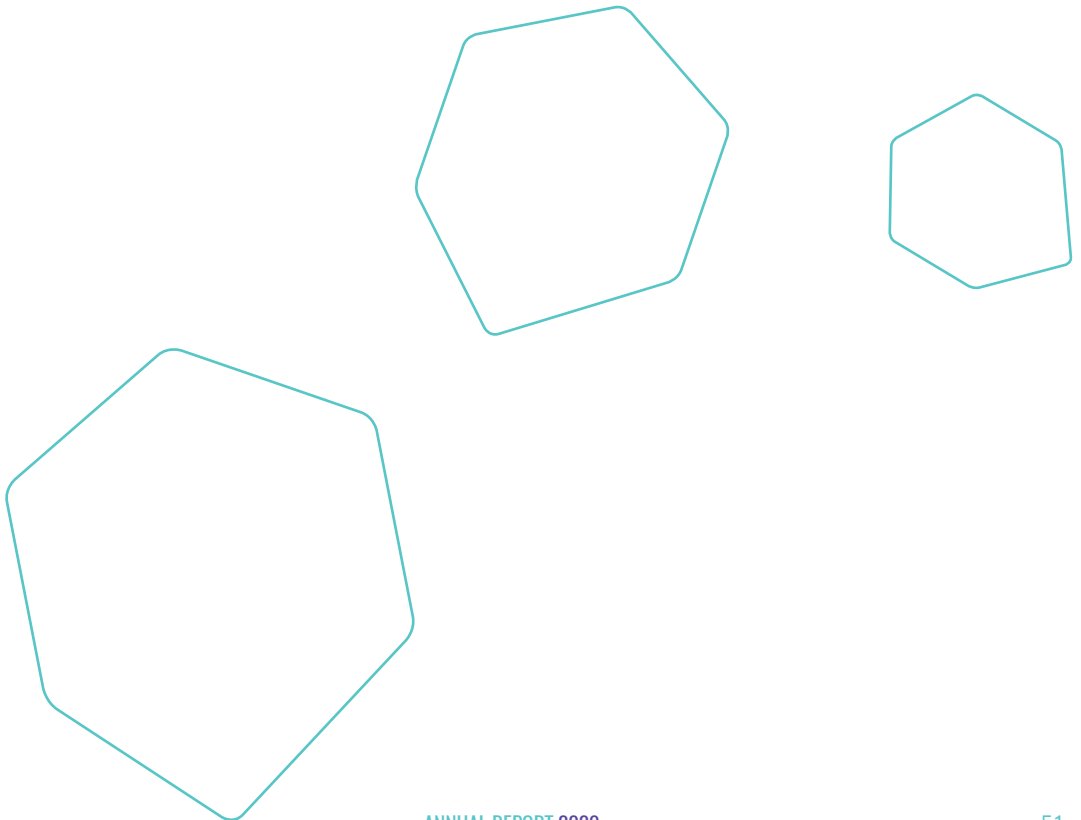


BIST also organised a new edition of the **BIST-Esade From Science to Business** course with the goal of bringing more entrepreneurship and innovation knowledge into the BIST centres. The programme kicked-off with a roundtable discussion with leading researchers, entrepreneurs, and founders of start-ups, followed by a four-day course between November 2-13. Students worked on their own scientific projects to develop a potential business plan and learned how to pitch in front of an investor. Learning outcomes included: getting acquainted with the business world, the venture creation process, and entrepreneurship as an attractive career path. For the first time this year, the course included participants from the ALBA Synchrotron and the European Molecular Biology Laboratory (EMBL).

Public Policy & Social Engagement

On May 21, 2020, the Career Webinar ***Getting ready to give your science a social impact: Becoming a Scientific Expert in Public Policy and Consulting***, took place. It featured Dr. Sonia Veiga, Biomedical Research Analyst and Consultant at SIRIS Academic, Dr. Joan Casals, Partner at Estratègia MomentumCO and Executive Consultant at the BRN Foundation, and Dr. Ana Valdivia, Data Scientist at Trilateral Research.

The Career Webinar series wrapped up with the session: **Getting ready for the big jump: The path to getting a Group Leader position**, which was held on June 4, 2020. It connected the BIST Global Science Programme to the Career Development Programme, detailed in the following section.



Career Development Programme

The 2020 BIST training programme to support researchers in different stages of their careers included some face-to-face activities in February and March, and a wide array of online activities designed precisely to help scientists work in a virtual environment.



The activities kicked-off on February 6 with a new edition of ***How to succeed in your PhD I***. This two-day course aims to help first-year PhD students be more effective doctoral researchers and get the most out of their PhD. A total of 48 students participated in the two editions of the course, which took place respectively from **February 6–7** and **February 20–21** at the BIST premises in the Escola Industrial (Barcelona). Leticia Chico (Head of Human Resources at ICIQ) and Dr. Núria Bayó facilitated the course and took part in creating the content based on the VITAE framework.

From **March 4–6**, a new edition of the **BIST Leadership in Action** course took place. This three-day interactive programme offers BIST postdoctoral fellows the opportunity to focus on developing those skills — resilience, problem solving, decision making, and effective communication — that are essential for successful self-management and development to progress in a professional career. Once again, the course was held at the Montserrat Hotel & Training Centre in Collbató. Thirty-three postdoctoral fellows participated this year.

After the COVID-19 lockdown was declared in mid-March, we started designing activities and materials to help the BIST Community continue training activities in this unique situation.

BIST Leadership in Action



We created the section **Talent Online Resources** on the BIST website, which offers useful information and access to materials (videos, documents, websites) for auto-training. The page is organised into three sections: Career Development, Mental Health & Wellbeing, and Transversal Skills.

On May 6, the **BIST Research Pitch Competition** call was launched, inviting the entire BIST Community to submit two-minute videos explaining their lab work. The objectives were to promote the research done at the BIST centres and to encourage creativity. The winners of the competition were: nine members of the Biosensors for Bioengineering Group at IBEC (1st place), Vincenzo Vitagliano and Oriol Pujolàs Boix of IFAE (2nd place), and Pilar Casado of IFAE (3rd place). The first and second place winning videos were presented for the first time at the 2020 BIST Conference on October 29, 2020.



The **BIST Virtual Creativity Course** taught by Holly Blondin also took place in May. The course included four sessions intended to make participants aware of their creative capacities, and to offer them simple techniques to help shape their creative practice. The ultimate objective was to provide participants with a creative toolbox to use in future activities. A total of 130 people attended the course.

Empowering Women Scientists



100tífiques event

BIST is committed to recognising the value and excellent research done by women scientists at the BIST centres, and to supporting and empowering them on their path to achieving leadership positions. BIST also aims to make more visible the research done by women scientists at the BIST centres and in Catalonia.

Specific actions have been taken to reduce the gender gap that exists in the BIST centres especially in higher level positions such as postdoctoral researchers (36% women), group leaders (18% women), and directors (0% women). These include the Maria Yzuel Fellowship Awards for undergraduate and master's female students (ICFO), the Libra Recruitment Handbook (CRG), work to achieve a minimum of 30% female group leaders (IBEC), gender balance in evaluation committees (ICFO, IRB Barcelona, CRG, ICIQ), training on "unconscious bias" for group leaders and heads of units (ICIQ), and inclusive language seminars (ICN2, CRG, IBEC, IRB Barcelona, ICIQ), among other projects.

At the BIST level, the main initiatives organised in 2020 were the **100tífiques** event and the **To the Mothers of Science** supporting grant.

In 2020, BIST once again teamed up with the Fundació Catalana per a la Recerca i la Innovació (FCRI), in collaboration with the Department of Education of the Generalitat de Catalunya, to organise the second edition of **100tífiques**, an initiative that aims to break gender stereotypes by highlighting the relevant and strategic roles women have in science and technology. On February 11, 2020 (the International Day of Women and Girls in Science), more than 180 female researchers from the business world and from research centres and universities delivered 150 simultaneous talks about science to some 15,000 young children at more than 100 schools all over Catalonia. The day's central



EDUCATION & TALENT

event took place in the auditorium of the Institute of Chemical Research of Catalonia (ICIQ, a BIST centre) in Tarragona.

Leading up to the event, the **100tífiques trobada de formació i networking** (Training and Networking Meet-up) took place on January 30, 2020. The main goal of the meet-up was to provide the tools needed for participating researchers to prepare their talks and to provide a space for networking and for learning about effective communication, science education, and bringing science to the classroom.



The second edition of the **To the Mothers of Science** programme, which aims to recognise women's roles as scientists and mothers and support them along their way to attaining positions of greater responsibility, also took place in 2020. Ten BIST researchers were awarded supporting grants in the form of a €400 monthly salary top-up over one year, and coaching sessions to strengthen leadership skills.

The winners have stated they are convinced this training will have a positive impact on their careers. **Belen Ballesteros** from the BIST centre ICN2 said, *"The coaching offered by this programme will help strengthen my leadership ability. Programmes like these give visibility to women, allowing them to become role models."*

EDUCATION & TALENT

Our experience demonstrates there are women who can work in science and be mothers, and that it is normal."

At the time of receiving the grant, **Dr. Irene Marco** from the BIST centre IBEC stated *"I am now at a point where I could apply to principal investigator or group leader positions, and I realise that sometimes I am the one who holds myself back."* Not long after, Dr. Marco was offered a position as the group leader of a new chemical biology research laboratory at IBEC, within the new "la Caixa" Foundation – BIST Chemical Biology Programme. She will be an integral part of creating a new hub in Barcelona for the design of new drugs – a truly immense and well-deserved achievement.

To the Mothers of Science 2020 grant winners



Dr. Gemma Aragay

Group Scientific Coordinator,
Institute of Chemical Research
of Catalonia (ICIQ)



Dr. Belen Ballesteros

Leader of the Electron
Microscopy Unit, Catalan
Institute of Nanoscience and
Nanotechnology (ICN2)



Dr. Mary Cano,

Senior Researcher, Catalan
Institute of Nanoscience and
Nanotechnology (ICN2)



Dr. Iliana López-Soldado

Research Associate, Institute for
Research in Biomedicine (IRB
Barcelona)



Dr. Irene Marco

Junior Group Leader*, Institute
for Bioengineering of Catalonia
(IBEC)



Dr. Claire Morgan

Postdoctoral Researcher,
Centre for Genomic
Regulation (CRG)

**at the time of receiving the grant, she held a position as Postdoctoral Researcher*



Dr. Sarah-Lena Offenburger

Postdoctoral Researcher,
Centre for Genomic Regulation
(CRG)



Dr. Malgorzata Siudek

Postdoctoral Researcher,
Institute for High Energy
Physics (IFAE)



Dr. Núria Torras

Postdoctoral Researcher,
Institute for Bioengineering
of Catalonia (IBEC)



Dr. Ewelina Wajs

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(ICFO)

Fellowship Programmes



BIST Barcelona Institute of Science and Technology

3 three-year postdoc positions
Call deadline October 6, 2020

BIST – FBA Fellows

Boost your research and teach in the fields of health, and energy and environmental sustainability

Three Junior Postdoc positions in a programme allowing the pursuit of ambitious research goals in a multidisciplinary setting, while benefiting from access to training and career development offerings.

With the support of: **F B A** Fundació Bosch Aymerich

Logos of partner institutions: CRG, IBEC, ICFO, ICIQ, ICN2, IFAE, IRB.

BIST is dedicated to providing excellent training for scientific researchers and aims to become an international reference in this area. In 2020, BIST reached several notable milestones within its international fellowship programmes including the **BIST–FBA Fellowships** and **PROBIST Fellowships** (both for postdoctoral researchers), and the **PREBIST Programme** and **BIST International Fellowships** (for PhD students).

The **BIST–FBA Fellowship Programme** was launched in 2020 as part of a collaboration with the Fundació Bosch Aymerich (FBA) and the Universitat Internacional de Catalunya (UIC Barcelona). Its aim is to promote outstanding scientific teaching and research in the fields of health and the environment. BIST contributed to the programme by recruiting three excellent postdoctoral BIST–FBA Fellows to carry out research



Dr. James Eills

in health (precision medicine in particular) and energy and environmental sustainability at BIST centres over three years. The selected researchers are Dr. **James Eills** from the University of Southampton, who joins IBEC, Dr. **Ekaterina Khestanova** from the ITMO University in Russia, who joins a multidisciplinary research project at ICFO and ICN2, and Dr. **Marion Salzer**, from CRG who will focus on cellular ageing and fertility.



Dr. Ekaterina Khestanova

In 2020, BIST focused on giving more visibility to the **PREBIST** and **PROBIST** fellows that were recruited in previous years and have begun their research at the BIST centres. The programmes are co-funded by the European Union's Horizon 2020 research and innovation programme under a Marie Skłodowska-Curie grant, and have brought 28 four-year fellows (PREBIST) and 61 three-year fellows (PROBIST) into the BIST centres. A dedicated webpage has been created for each programme's fellows (PREBIST: bist.eu/prebist-fellows; PROBIST: bist.eu/probist-fellows), with photos, research groups, and details about their ongoing research. Many fellows have also become involved in BIST activities as well, such as the third edition of the **BIST Postdoctoral Day**, which was held in three sessions on November 19, 26, and December 10. Several PROBIST fellows participated actively in the event's organisation.



Dr. Marion Salzer

The **BIST International Fellowship Programme**, which was launched in 2016 as a pioneering initiative with eight international PhD fellows, wrapped up in 2020. The selected fellows completed cutting-edge multidisciplinary research at the BIST research centres over four years, which has prepared them to succeed in high-level research or industry positions anywhere in the world.

BIST & SOCIETY



The Pandemic and the BIST Community

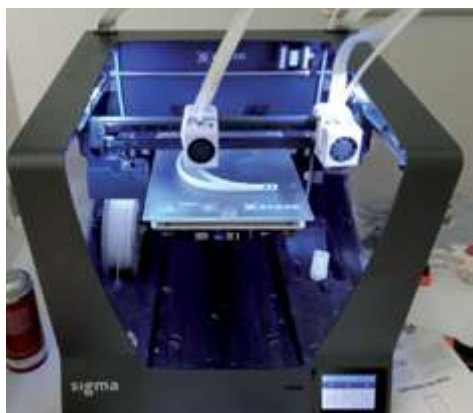
The Barcelona Institute of Science and Technology (BIST) is committed to serving society, which means aligning our research with big social challenges and involving the BIST Community in impactful social projects, from acts of solidarity to educational or artistic activities.

The BIST centres have been committed to fighting the COVID-19 pandemic since the very beginning, both through research projects (described in the *Research & Innovation* section) and through generous social initiatives.

In the first months of 2020, when the pandemic first swept through the world, there was a sudden and urgent call for PPE equipment at

hospitals and health clinics. The BIST centres ICIQ, CRG, ICN2, ICFO, IFAE, and IRB Barcelona donated gloves, masks, protective goggles, sanitising gel, alcohol, booties, and lab coats. These essential items went to hospitals and clinics in Catalonia including Hospital del Mar, Parc Taulí Hospital Universitari, Hospital Germans Trias i Pujol, Hospital de la Santa Creu i Sant Pau, and Hospital Vall d'Hebron, among others.

The BIST centres ICIQ, CRG, and IFAE also used their 3D printers to produce essential equipment including supports for face shields, PPE, and components for ventilators and other medical equipment, which were donated throughout Catalonia.



3D printer at ICIQ producing supports for face shields



A strategic agreement with the Generalitat's Education Department



In December 2020, BIST signed an agreement with the Generalitat's Education Department which outlines how BIST will collaborate in the development of the Angeleta Ferrer High School, a new reference centre in STEAM education that will start its activity in the 2021/2022 school year. The agreement culminates months of work defining the project, as well as the contributions by BIST and its centres.

The new STEAM centre, managed by the Barcelona Education Consortium, is intended to be the central node of a network of high schools across all of Catalonia that will foster new approaches in STEAM education (science, technology, engineering, art, and mathematics). The Angeleta Ferrer High School will be a reference training centre for science teachers, and will promote a gender perspective in scientific and technological fields to increase the visibility of women in these sectors. The school will be committed to economic and social equity, and enrolment will not be based on merit but on proximity to the school district.



BIST will support the Angeleta Ferrer High School through various actions, including training and retraining teachers, sending BIST researchers as visiting professors, welcoming students to the BIST centres for visits and stays, designing practice laboratories and help equip them, and contributing to innovation in science teaching, to the internationalisation and visibility of the centre, and to networking.

2020 BIST Conference



The fourth edition of the BIST Annual Conference took place on October 29, 2020, with satellite sessions from October 26 to 28. The programme was focused on the latest developments in an area of priority for BIST research: sustainability. Due to the COVID-19 pandemic, the conference took on a semi-virtual format: the 400 attendees and various speakers joined remotely, while some local speakers presented from the BIST headquarters.



Dr. **Esther Alarcón Lladó**, 3D-Photovoltaics Group Leader at AMOLF in Amsterdam, gave the first keynote speech of the day, about *Nanostructures for Solar Energy: New Device and Fabrication Concepts*.

Dr. **Philip Ball**, renowned science writer and broadcaster, challenged participants in his keynote speech to ask themselves whether science can continue to fulfill its social contract. Dr. **Elisabet Romero** (ICIQ), who acted as the 2020 Scientific Programme Chair and Master of Ceremonies, moderated the discussion with Dr. Ball.

The programme also included two roundtable discussions: the first about Metal Organic Frameworks (MOFs) for pollution remediation



and the second about solar and bio-inspired energy solutions. **Tania Patiño** (IBEC & University of Rome Tor Vergata), **Leyre Gómez Navascués** (ICN2), **Cristina Sáenz**, Founder and former CEO of Orchestra Scientific, and moderator **Alfredo Ongaro** (ICFO) participated in the first discussion, while **Pau Gorostiza** (IBEC), **Jordi Martorell** (ICFO), **Antoni Llobet** (ICIQ), and moderator **Mónica Lira-Cantu** (ICN2) were part of the second.

In the days leading up to the conference, three satellite sessions were also organised on relevant current topics.

On October 26, speakers **Isabelle Vernos** (CRG), **Núria Montserrat** (IBEC), **María García-Parajo** (ICFO), **Mónica H. Pérez-Temprano** (ICIQ), **Néus**

Domingo (ICN2), **Neus Prats** (IRB Barcelona), and **Nuria Bayó** (BIST), and moderator **Toni Pou** (Journalist) discussed *Closing the Gender Gap in Research: Collective Challenges Ahead*.

Speakers **Jorge Cham** (PhD Comics), **Berta Roca** (BertaRoca&Co), and **Frank Kupper** (Athena Institute) talked about *The Future of Science Communication* with moderator **Àlex Argemí**, (ICN2) on October 27.

Finally, the roundtable *How to Engage Research Institutes in Sustainable Research* took place on October 28 with **Donate Weghorn** (CRG), **Teresa Sanchís** (IBEC), **Marta Ventosa** (ICIQ), **Andrea Bonaccini** (ICN2), **Gonzalo Merino** (IFAE), **Tiago Botelho** (IRB Barcelona), and moderator **Xavier Gabarrell** (ICTA-UAB).



Engaging people in science

The BIST centres organised around 240 outreach activities in 2020 that gathered nearly 50,000 people in total, including more than 8,400 primary and secondary school children, and more than 40,000 adults. Due to the COVID-19 pandemic we converted some of our traditional outreach programmes into online versions, which participants followed from home.

Among the many online outreach programmes organised in 2020, some were completely new events while others were re-vamped versions of in-person programmes. Some examples of these activities are described below.



ICFO adapted two activities that reach more than 1,200 participants every year, to a virtual format: the ICFO Decide Game and Quantum Technologies in 5 Minutes. **The ICFO Decide Game** is an activity that puts participants in the shoes of policy makers responsible for research and innovation. The programme has run several times a year for three years in three different

thematic editions: climate change, physics and quantum technologies, and “ICFO”. **Quantum Technologies in 5 Minutes** involves four scientists who have five minutes each to explain in an inspiring and engaging way, why quantum technologies have become so important. Students have a chance to ask questions, which the speakers answer in interactive ways.

ICIQ transformed its traditional **Crazy for Chemistry** into a virtual activity in 2020. The centre prepared and sent boxes of chemistry products and lab materials to students’ homes (which they could keep). Students recorded themselves on video using the materials to do experiments and later shared the video with their groups. ICIQ also participated in the 2020 edition of **Researchers’ Night** (*Nit de la Recerca*) in Tarragona, which took place on November 27 (it is usually scheduled for the last week of September). Tarragona’s *Plaça Corsini* was virtually recreated for the event, and all participating research entities had their own virtual stand to mimic the usual in-person format. ICIQ participated by presenting several videos they had created.



Other BIST centres also participated in Researchers' Night, which had hubs all over Catalonia, including one in Barcelona. **CRG** presented their citizen science project **Genigma**, a game in the form of a mobile app to explore the genomic alterations in cancer cells. Several researchers from **ICFO**, **CRG**, **ICN2**, **IBEC**, and **IRB Barcelona** gave "micro-talks" about their research, which were streamed through the Researchers' Night YouTube channel. **IBEC's** ICREA Professor Núria Montserrat for example, presented a micro-talk about her work studying organoids to better understand COVID-19. **ICN2** also participated in the organisation of several **Nano Workshops**.

IBEC also launched a new programme called **Ciencia con #inGENIO**, a video series made during lockdown with two **IBEC** researchers who guided participants through experiments that could be done from home.

Last but not least, BIST became part of the Barcelona Art, Science and Technology Hub (originally named Artech Hub and later renamed **HacTe**). The initiative aims to explore and develop intersections among art, science, and technology to boost the digital transformation of society, and to make Barcelona a global centre for research, training, dissemination, transfer, and production in this area. BIST and the BIST centre **ICFO** are among the nine institutions involved in this initiative, which officially launched on December 21, 2020.



Communicating BIST

BIST obtained a total of 273 media impacts in 2020, mainly in online coverage. The most impactful news item was about the launch of the International Architecture Competition, a call for applications to design the new BIST building at the Antic Mercat del Peix, as well as the corresponding announcement of the first phase winners.

Concurs per dissenyar el nou centre científic i tecnològic que s'instal·larà a l'antic Mercat del Peix de Barcelona

El nou edifici singular té un pressupost de 50 milions d'euros

10/11/2020



El complejo de innovación de la Ciudadella empieza a caminar

Antes de la transición tecnológica de los edificios en los que se invertirán 100 millones de euros



Overall, BIST and its seven centres generated 5,476 news pieces in 2020. These were published in newspapers (15.7%), online media (81.4%), radio (1.6%), and TV (1.3%), and most presented research results. Throughout the year, a high percentage of these research-focused pieces were about the contributions by BIST researchers to the fight against COVID-19.

The reach of the BIST social media accounts grew steadily throughout 2020. BIST followers on **Twitter** grew by 1,177, reaching a total of 4,645 people. The tweets we sent gained more than 910,000 impressions in total (an increase of 71% compared to 2019), as well as 18,639 engagements. Profile visits grew by 56%, reaching 13,009 in 2020, while mentions increased by 98%, bringing the total to 1,584.

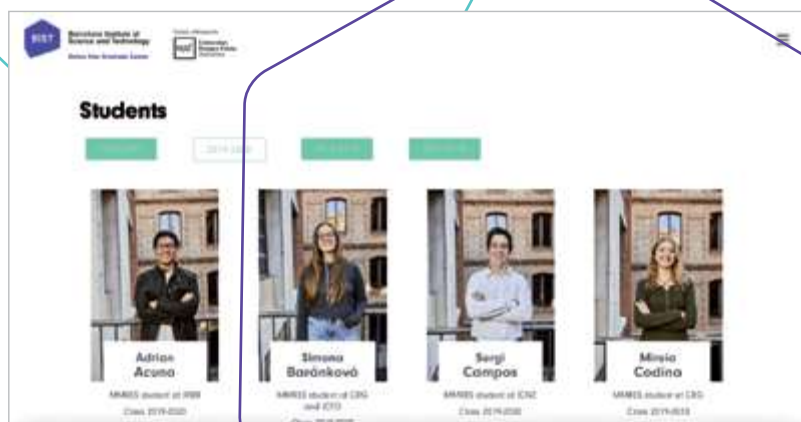
The BIST **Facebook** page also saw significant growth. Our organic reach through this account was 12,537 people (36% more than in 2019), generating 1,878 engagements (75% more than in the previous year). Additionally, we launched a marketing campaign to recruit students for the BIST Master of Multidisciplinary Research in Experimental Sciences (MMRES) in December 2020, which reached 107,657 people in just two weeks, producing more than 284,192 impressions.

The BIST **LinkedIn** page ended 2020 with a total of 3,093 followers. We received 3,737 visits from more than 1,400 users on this channel throughout the year. Finally, the BIST **Instagram** account, which was created at the end of 2019, gained more than 400 followers in 2020.

Thanks to the ongoing cooperation in the area of communication among the BIST centres and the BIST Foundation, our reach has increased immensely. All together, we had more than 62,600 followers on Twitter and

more than 63,600 followers on LinkedIn at the end of 2020.

As for the **BIST website** (bist.eu), we had 87,684 sessions from 63,170 unique users in 2020. These figures are slightly smaller than those from 2019 due to the redirecting of some visits to the **new BIST Master of Research website** (mmres.bist.eu), which was launched at the end of September 2020. From October to December, this new site received 6,464 visits from a total of 4,556 unique users.



BIST Friends

A top BIST priority is to bring science closer to society, offering citizens, social organisations, foundations and companies opportunities to participate in promoting and funding a cutting-edge research agenda.

BIST Friends are organisations and individuals who have chosen to support our work in exploring the frontiers of knowledge, helping us find innovative solutions for great social challenges.

We want to thank the growing community of BIST Friends for their commitment to help in our research and innovation efforts, focused on moving towards a healthier and more sustainable world.

At the end of 2020, "la Caixa" Foundation left the Board of Trustees to become a BIST Friend, joining the foundations that comprise this supporting group.



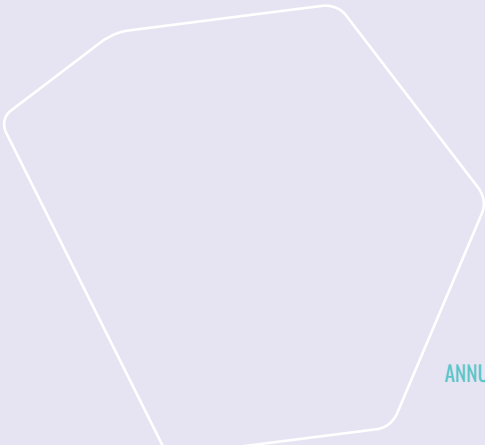
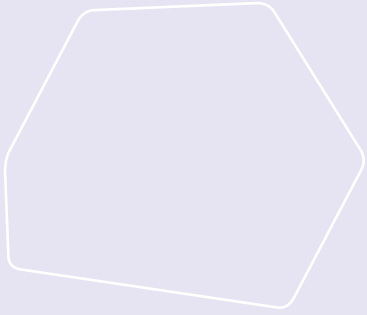
Institutional Relations







FACTS & FIGURES





PEOPLE

2,568

BIST COMMUNITY

40%

International

46%

Women

177

Principal
Investigators (PIs)

566

Postdoctoral
Researchers

679

PhD
Students

107

Master
Students

10

BIST Core
Team



OUTREACH

233

OUTREACH ACTIVITIES

49,366

PEOPLE REACHED



PUBLICATIONS 1,403

PUBLICATIONS INTERNATIONAL BENCHMARKING (2016-2020)

Institute	% HCP	C/AR
Caltech	4,50%	21,82
BIST	4,02%	21,63
Weizmann Institute	3,98%	21,21
Imperial College London	3,67%	18,67
RIKEN	2,43%	13,84
Leibniz Association	1,95%	14,06

HCP = Highly cited publications

C/AR = Citations per article/review



INNOVATION

37

ACTIVE SPINOFF
COMPANIES
(AS OF DECEMBER 2020)

68

NEW PATENT APPLICATIONS



ERC GRANTS

142

TOTAL GRANTS
TO BIST RESEARCHERS
(2007-2020)

8

NEW ERC GRANTS (2020)



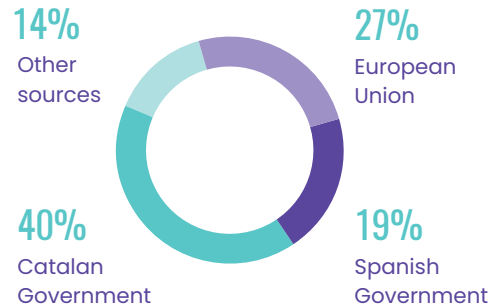
FUNDING

147.4 M €

BIST & BIST CENTRES
BUDGET

2.2 M €

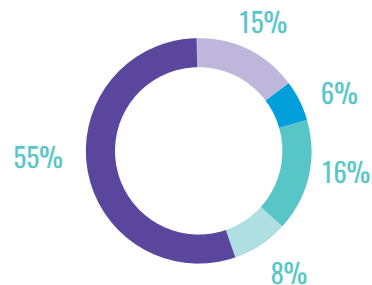
BIST BUDGET



Sources



Activities



205.8 M €

H2020 CONTRIBUTIONS
TO BIST & BIST CENTRES
(CUMULATIVE 2014-2020)

- Research & Innovation
- Education & Talent
- Communications
- Institutional projects
- Operational

BIST CENTRES



INSTITUTIONAL MEMBERS OF THE BOARD OF TRUSTEES

