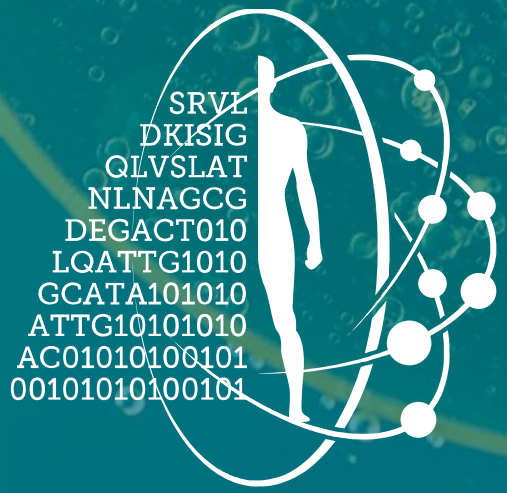


BioISI

Biosystems and Integrative Sciences Institute

Evaluation 2018 - Support Documents

5th November 2018

Contents

BioISI Identification

Name of the Research Unit: Biosystems & Integrative Sciences Institute

Unit Acronym: BioISI

Scientific Director: Margarida Sofia Pereira Duarte Amaral

Scientific Areas: Multidisciplinary/Interdisciplinary Research

Molecular Biology & Biomedical Sciences
Biological sciences
Physics
Chemistry

Keywords Multidisciplinary Research
Molecular Systems Biology
Bioinformatics & computational modelling
Integrative Sciences
Quantitative biology

Management Institution:

FCiências.ID – Associação para a Investigação e Desenvolvimento em Ciências

Participating institutions:

Instituto Nacional de Saúde Dr. Ricardo Jorge (INSARJ)

Universidade do Minho (UM)

Universidade de Trás-os-Montes e Alto Douro (UTAD)

Emails: Director: BioISIdirector@fc.ul.pt / Secretariat: BioISInfo@fc.ul.pt | Webpage: http://www.bioisi.pt

Address: Campo Grande C8 Bdg, room 8.2.42, 1749-016 Lisboa, Portugal | Tel - +351 21 7500857 Fax - +351 21 7500088

Introduction

Biological systems display complex properties that cannot be predicted from studying isolated parts. Addressing such complexity calls for integrative analyses combining high-throughput Omics with quantitative science and computational tools to describe and predict dynamical behaviours.

Vision in Systems Biology

The vision of BioISI, a new institute created in 2015 (http://www.BioISI.pt) is to pursue cutting-edge research on biosystems and integrative sciences to become the leading centre at the forefront of research in this area in Portugal and internationally.

Goal & Missions

BioISI's goal is to understand and address biological questions using integrative -Systems- approaches at the vanguard of life sciences research. Is researchers benefit from a unique multidisciplinary environment that fosters creative thinking to solve problems through integrative approaches. To achieve its vision BioISI pursues 5 major missions:

1. Research in BioSystems & Integrative Sciences
2. Technology & Instrumentation
3. Facilities and Services
4. Teaching and Training
5. Knowledge/ Technology Transfer

Strategic objectives for 2018-2022

1. Taking a lead role in Biosystems/Integrative Sciences research nationally and internationally
2. Driving research and progress through technology development and innovation
3. Training next generation scientific leaders in Biosystems/Integrative Sciences
4. Providing research facilities and services to BioISI researchers and externally
5. Become a major player in industry partnerships and technology transfer for life sciences

These strategic objectives will be implemented along **BioISI's 5 main Thematic Lines (TLs):**

1. **Biomedicine**: to understand molecular/cellular mechanisms of disease and translate findings into improved diagnoses/prognoses and better personalized therapies.
2. **Biotechnology**: to characterize at systems-level economically relevant plants and microbes to sustainably meet the challenges of global climate changes while safeguarding the environment.
3. **Biological Chemistry**: to develop bioactive molecules (by synthesis or from natural sources) and understand molecular mechanisms of (bio)chemical systems (e.g. molecular/cellular bioenergetics).
4. **Bioinformatics**: to promote digital biology at large, fostering the generation of systems-level knowledge and models to describe and predict the behaviour of complex biological systems.
5. **Biological Physics**: to develop the study of bio-systems using physical models and tools, eg, novel simulation approaches to address protein (mis)folding, atomic force microscopy related techniques for molecular/mechanical forces assessment in biological systems.

BioISI strategy is to cluster its competences in 3 main societal challenges as ´**Flagship projects**´:

1. Crop/product improvement & contributions to bioeconomy: grapevine and wine
2. Systems approaches to rare diseases: Cystic Fibrosis and neurodegeneration
3. Enabling technologies: AFM/FFM tools and innovative computational approaches

To achieve its strategic 2018-22 goals BioISI proposes to:

1. Strengthen BioISI research, technology development & innovation by: hiring 10 new PIs in key BioISI areas; expanding current BioISI internal multidisciplinary projects.
2. Reinforce training: create a Junior Studentships Programme dedicated to early career researchers; expand both PhD (BioSys2) and Interdisciplinary Postdoctoral (IPP) programmes.
3. Invest in core-facilities: hire dedicated human resources; upgrade equipment;
4. Stimulate scientific dissemination: organize conferences, seminars, workshops, courses;
5. Foster scientific & technological culture in society: promote multiple outreach events;
6. Encourage collaborations with industry and boost knowledge & technology transfer (KTT): Establish a BioISI-Industry Partnership Programme and hire a dedicated KTT officer.

BioISI Governance

Research at BioISI focuses on integrative approaches to biological problems at the forefront of life-sciences. In order to benefit from a unique multidisciplinary environment which gathers scientists from diverse areas, BioISI research is organized into 5 Thematic Lines (TLs) each functioning as a collaborative project led by a Coordinator (TLC) and Vice-Coordinator (TLVC), namely:

1) Biomedicine (BioMed): MD Amaral/CM Gomes
2) Biotechnology (BioTech): R Malhó/R Tenreiro
3) Biological Physics (BioPhys): MM Godinho/A Nunes
4) Bioinformatics (BioInfo): L Correia/ MG-Carvalho
5) Biological Chemistry (BioChem): MJ Calhorda/P Costa

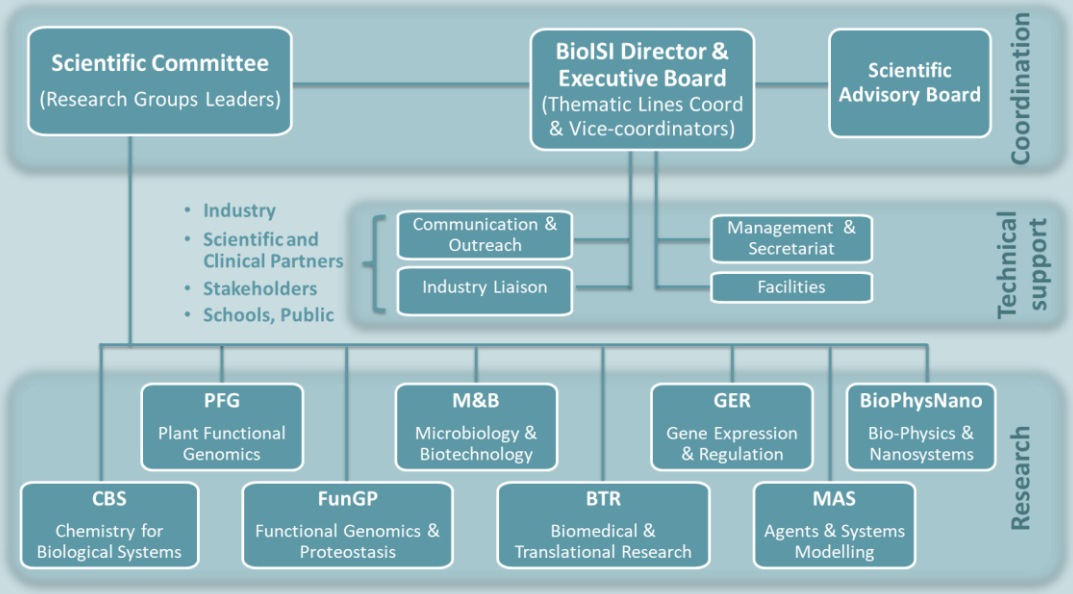
Each TLC is a former centre coordinator with past experience managing internationally funded research, being also a research group leader (RGL). TLCs/VCs promote specific activities and exchange of information to exploit collaborations enhancing multidisciplinary research.

Research groups

BioISI has 8 research groups (RGs) each headed by a RG leader (RGL) and containing multiple teams (headed by PIs).

1. Plant Functional Genomics Group (PFG): R Malhó
2. Functional Genomics and Proteostasis Group (FunGP): MD Amaral
3. Microbiology & Biotechnology Research Group (M&B): R Tenreiro
4. Biomedical & Translational Research (BTR): AM Vicente
5. Gene Expression and Regulation (GER): M G-Carvalho
6. Bio-Physics & Nanosystems (BioPhysNano): MM Godinho
7. Agents and Systems Modelling (MAS): L Correia
8. Chemistry for Biological Systems (CBS): MJ Calhorda

Each RGL will coordinate research by the involved teams contributing to different TLs. Each RGL reports progress to the EB (Executive Board). The teams are grouped based on common scientific areas, methodologies and shared technologies.



BioISI Director General (DG)

MD Amaral has significant expertise in leading large international projects. As EMBL alumna, she has a strong vision to promote science of excellence and a high international standing. Activities at EMBL and other top institutions are intensely disseminated and usage of facilities strongly promoted among BioISI researchers. A Vice-Director (R Malhó) assists and replaces the DG, when needed.

Executive Board (EB)

BioISI Director, assisted by the TLCs/VCs, form an Executive Board (EB) who implements BioISI strategic plan and Scientific Advisory Board (SAB) recommendations and proposes strategic guidelines to the Steering Scientific Committee (SSC)

Management Institutions

FCiencias.ID (FCID) is BioISI's main managing institution, whereas the participating institution FCUL provides the infrastructures accommodating most of BioISI labs and facilities.

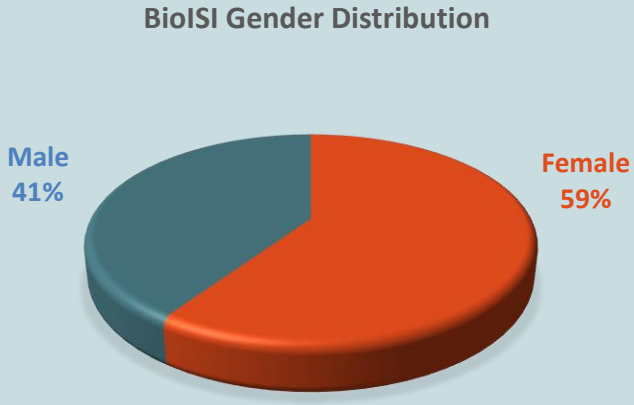
Other BioISI managing institutions (poles) include:

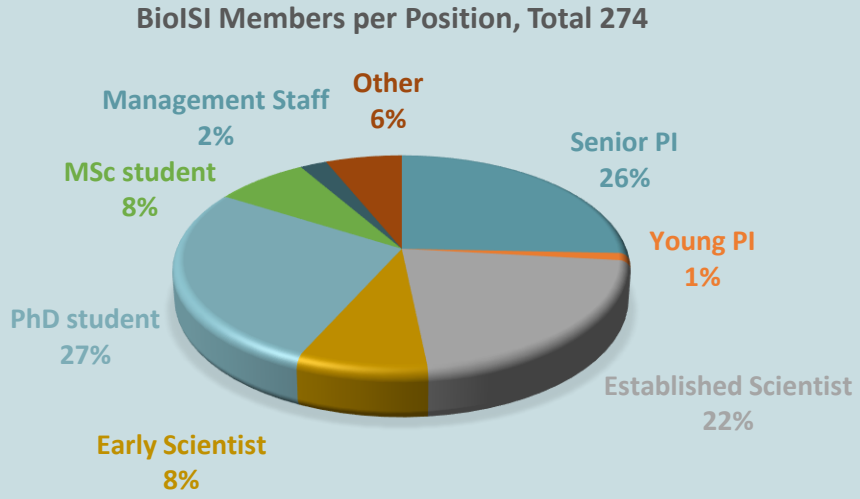
1) **INSA:** is the National Institute of Health in Portugal, and its involvement is of high strategic relevance for the impact of BioMed-TL research results. Being within FCUL walking distance, interactions among BioISI researchers at INSA and FCUL occur as if they were at FCUL campus.
2) **UTAD & UM:** both in Northern Portugal, involve teams in BioMed & BioTech TLs. Despite being far from FCUL, their involvement in BioISI is of strategic relevance for the establishment of an inter-regional network on specific societal topics. Regular webconferences ensures discussion of progresses among teams involved and joint supervision of internal projects and students strengthens collaborative work.

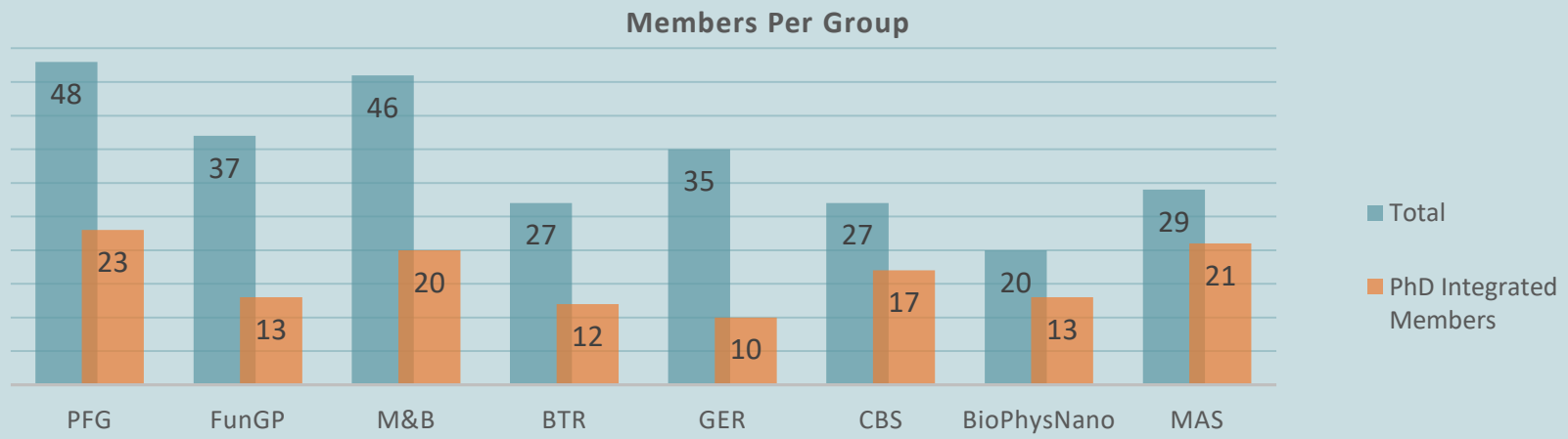
All managing institutions are responsible for local administrative and financial procedures in coordination with FCID to optimize research and avoid hurdles. Each pole has a local project manager and a scientific coordinator ensuring optimal flow of information to and from BioISI director.

BioISI in Numbers

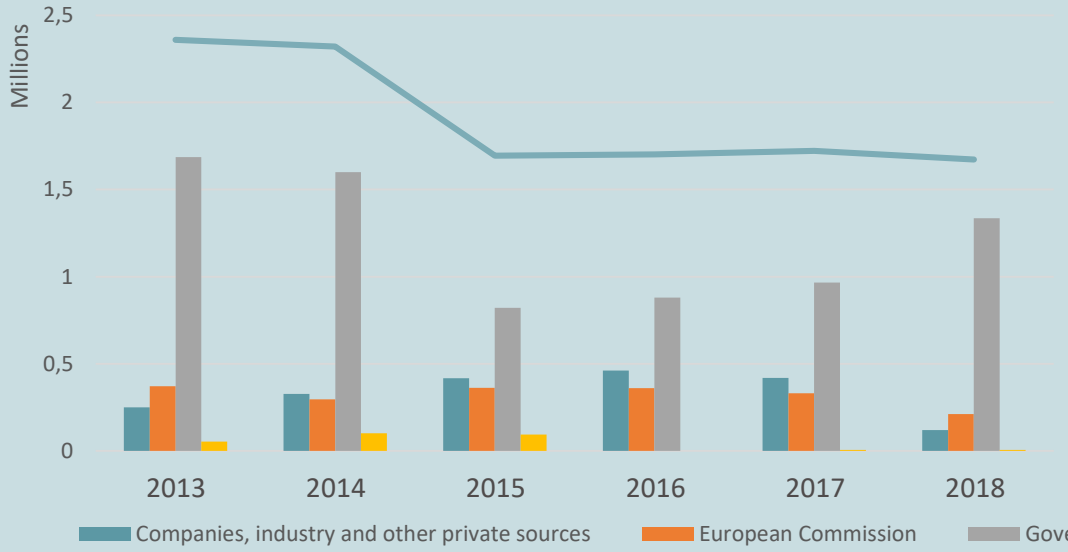
Members:

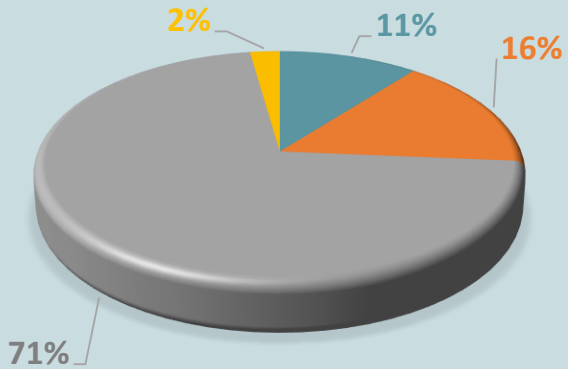




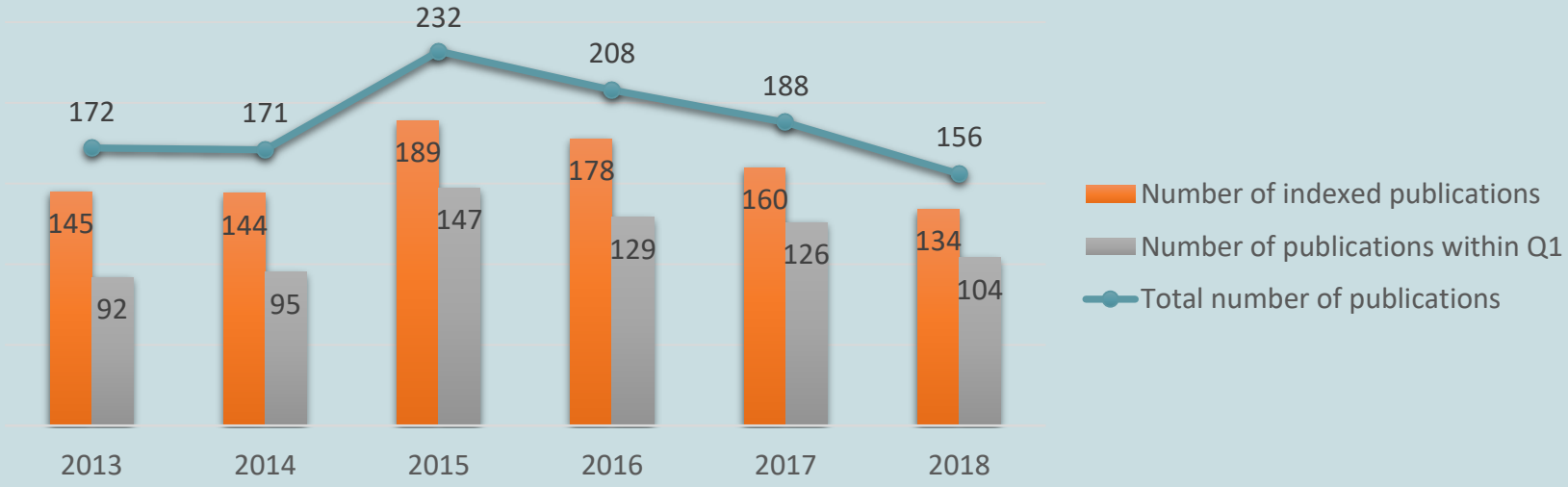


Project Funding 2013-2018



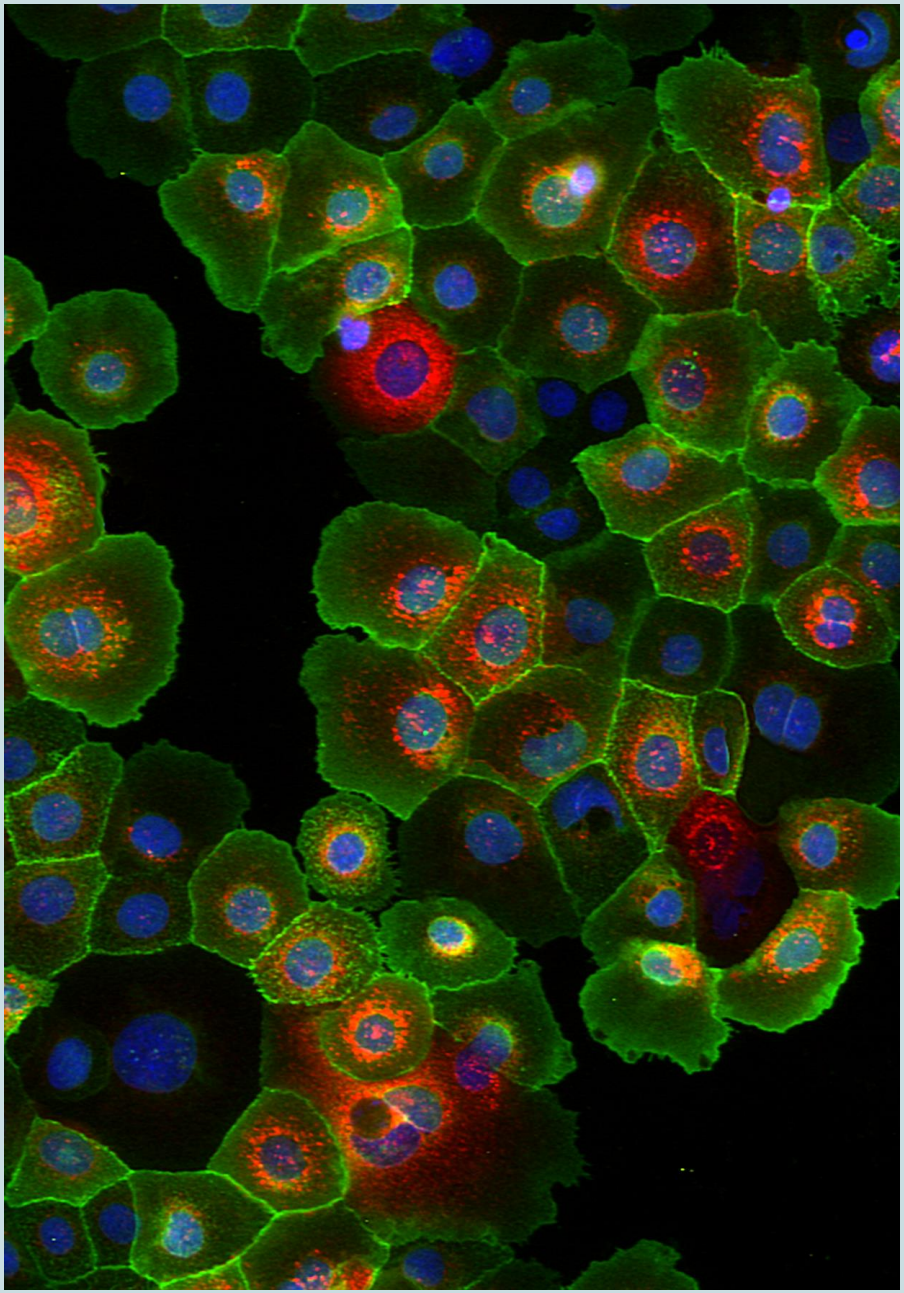


Bibliometrics



Outputs Supporting the vision and strategic objectives

BioISI vision and goals for 2019-22 are substantiated in several achievements and track record in 2013-2017 by its critical mass of ~130 researchers from different disciplines (biology, chemistry, physics, computer science), evidencing how BioISI contributes with significant added value to the development of the national R&D system. Highlights of 2013-17 were:



BioISI Thematic Lines

CFBE cells expressing the traffic reporter protein tsO45-VSVG. In this cell monolayer VSVG can be seen in intracellular carrier vesicles (red) or at the cell surface (green). Cell nuclei are in blue.

Biomedicine

Conventional approaches relying in exploration of a single gene or a single process/target are no longer valid. We thus seek to implement new approaches to solve health problems based on a systems-level analysis of causative pathways including genes, biomolecules, environment, lifestyle.

BioISI is ideally positioned to pursue ambitious research on systems biomedicine for personalised diagnosis, molecular/ cellular disease mechanisms & therapies. Its disruptive research blends classical (molecular/cell biology) with emerging disciplines (omics, computational, systems biology) and taking the most of BioISI facilities. We have the required expertise, resources and track record to leverage significant advances in biomedicine of complex systems.

Goals

1. Understanding molecular/ cellular mechanisms of disease;
2. Translating high-throughput biology into disease risk, diagnosis, and prognosis;
3. Developing innovative therapies & drug discovery.

Proposed Research
Focused on

- Mechanisms and networks of rare diseases and neurodegeneration
- Genomic and environmental factors of multifactorial disorders
- Signalling processes in health and disease
- Personalised therapies: molecular biomarkers, biologics and small molecule drugs

Proposed Actions
promoted by the Thematic Line

- Annual Hands-On Workshop On Fluorescence And High-Throughput Microscopy
- Annual Epithelial Systems: Physiology and Pathophysiology Workshop
- "Data-driven Biology" Summer School
- Systems Biology in Biomedicine Conference

Biotechnology

Knowledge derived from integrative studies can bring about a non-negligible positive impact. Thus, characterization of plants and microbes at the genetic, molecular and physiological level can significantly increase their biotech potential.
Biotech-TL is framed by societal challenges: functional foods for disease prevention, new drugs from marine organisms, safe and sustainable agriculture.
Systems-level research will generate new knowledge and develop modular tools to enable rapid responses to new challenges, eg the emergence of new plant or diet-related diseases, changes in pathogens/ vectors distribution or impact assessment of new bio-based products.

Goals

1. Characterizing at systems-level economically relevant plants and microbes to sustainably meet the challenges of global climate changes while safeguarding the environment;
2. Identify natural compounds so as to become drugs or added-value nutraceuticals;
3. Ensure food traceability and authenticity.

Proposed Research Focused on	Proposed Actions promoted by the Thematic Line
Plant health	4th Generation Sequencing industry-oriented workshop
Crop improvement and security	Genome Editing industry-oriented workshop
Microbial biotechnology	Annual post-grad courses (e.g. Applied microbiology/Mycology)
Microbial pharmacogenomics	Dissemination Events to raise public awareness

Biological Chemistry

Chemical knowledge at the molecular level is a key factor to design better drugs, understand structural changes triggered by the environment (eg pH or binding of a substrate), or study mechanisms related to enzyme function. We thus wish to solve health problems using integrative (bio)chemical approaches.

We have the expertise to advance BioISI objectives significantly in rare disease diagnoses and therapy at both molecular & cellular levels. We combine computational and experimental approaches ranging from (in)organic to biochemical and cellular levels. We plan to address health and environmental safety problems, either directly (eg new leads) or indirectly (solving mechanisms or designing eco-friendly molecules and processes, or by unravelling pathogens bioenergetics).

Goals

1. Developing bioactive molecules either by synthesis or extraction from natural sources;
2. Understanding molecular mechanisms of (bio)chemical systems, from small molecules, to proteins, membranes, and cells;
3. Widening the knowledge of molecular and cellular bioenergetics.

Proposed Research
Focused on

- Bioactive molecules
- Molecular mechanisms of (bio)chemical systems
- Molecular and cellular bioenergetics

Proposed Actions
promoted by the Thematic Line

- Annual Biological Chemistry international workshops
- Biennial Multifunctional Magnetic Materials Workshop (SPINON)
- Organization of two H2020-MSCA-ITN-2018 topics
- Organization of 9th EuCheMS Chemistry Congress 2020

Bioinformatics

Computational means have become an essential tool to advance the study of living systems globally. At BioISI we follow this systems-level approach through research and development of tools for:

1) quantitative biology and multilevel, real-time, large-scale integration of biological data;

2) digital representation, modelling and simulation of biological systems;

3) knowledge production, sharing and innovation.

Goals

1. Gather research in digital biology at large
2. Develops systems-level knowledge and models to describe and predict the behaviour of complex biological systems
3. Extends over the activity of all BioISI groups

Proposed Research
Focused on

- Novel computational tools for multilevel data integration and modelling
- Innovative algorithms for knowledge discovery from Nanopore-based devices
- Models of gene regulatory networks in signalling and protein-protein interactions
- Multi-agent models and simulations of living and artificial life systems

Proposed Actions
promoted by the Thematic Line

- Computation for Life Sciences Sessions
- Integrative Approaches in Neurodegeneration Workshop
- Bioinformatics and computational modelling for Systems Biology Workshop

BioPhysics

A systems-level analysis unravels the interplay of processes at different scales. The expertise of the physics team in AFM and magnetic studies is crucial to probe and manipulate biosystems at the smallest scales. Theoretical understanding at these scales involves physical models and computational approaches that are also part of our expertise.

Modelling, computational and high-resolution approaches will be applied to help solving biological problems, namely: i)protein folding, a long-standing interest in the core group; ii)biomedical applications of the core group's expertise in magnetism (eg magnetic nanoparticles for hyperthermia); iii)physical studies of biological systems at nanoscale (using AFM/FFM or ab initio methods applied to molecular mechanisms in photosynthesis).

Goals

1. Nanostructured systems to act as bio/ biomimetic-devices;
2. Atomic force microscopy (AFM)/force feedback microscopy (FFM) to probe mechanical and intermolecular interactions in bio-systems;
3. Novel simulation approaches to study protein (mis)folding & aggregation;
4. Theoretical studies of dynamics and electronic structure in molecular systems.

Proposed Research
Focused on

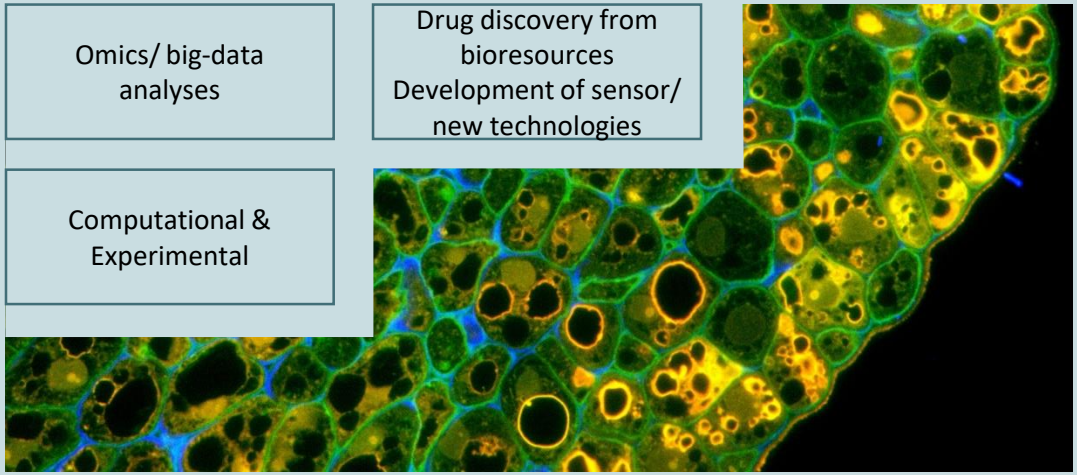
- Protein folding physics
- Nanostructured magnetic systems
- Development of AFM/FFM methodologies
- Biomimetic photosynthesis and molecular solar energy storage

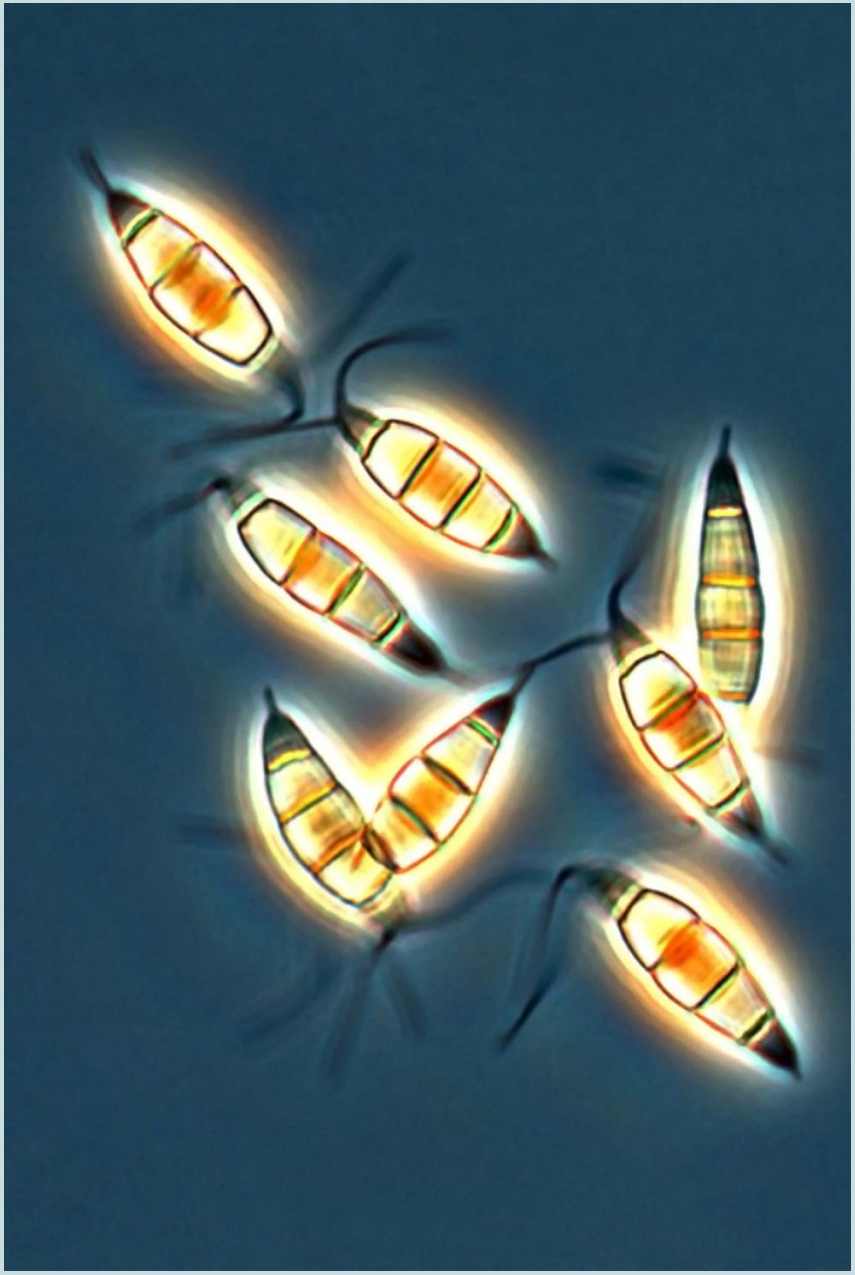
Proposed Actions
promoted by the Thematic Line

- International workshops and Summer Schools on innovative physical approaches to tackle biological issues
- 2 day conference on The Physics of Living Systems

Integrated Research

	BioPhysics	Bioinformatics	Chemical Biology	Biotechenology
Biomedicine	Development of new enabling technologies/ biomedical devices	Omics/ big-data analyses	Drug development	Drug discovery from bioresources
Biotechenology	Developing of enabling technologies/field devices	Omics/ big-data analyses	Drug discovery from bioresources Development of sensor/ new technologies	
Chemical Biology	Development of sensors/ new technologies	Computational & Experimental		
Bioinformatics	Innovative modelling/ computational approaches			





BioISI Research Units (Groups)

Asexual spores of a *Pestalotiopsis* species (fungus) found growing on decorative tiles at Palacio da Pena, Portugal. The image was taken with phase contrast optics

PFG Group
Plant Functional Genomics

http://bioisi.pt/pfg/

PFG is devoted to the study of plant growth and development with emphasis on functional aspects. It includes members from three institutions (FCUL, UM, UTAD) forming a national network to promote plant research. Despite its pivotal role in science and society, the area is facing a global decrease in interest from decision makers and young biologists. PFG aims to attenuate such trend by joining experts in fields as diverse as functional genomics, physiology, cell biology, and biochemistry with a successful collaborative track record. PFG has a project-oriented organization with PIs reporting to the GL ensuring flow of information and maximizing resources.

Selected Publications 2013-18:

1. New Phytol, 2014, 203, 784-793 doi: 10.1111/nph.12836 - Characterization of FAB1 phosphatidylinositol kinases in Arabidopsis pollen tube growth and fertilization

A pollen specific kinase was shown to exhibit a highly mobile reticulate-like distribution and decorating the shank region in a manner similar to the actin cytoskeleton suggesting that the protein distribution includes the endoplasmic reticulum and possibly trans-Golgi network mediating transport to and from the plasma membrane. This study called for a reassessment of FAB1 and PI(3,5)P2 localization in other systems and could unravel previously unknown functions.

2. J Exptl Bot, 2015, 66, 1769-1785 doi: 10.1093/jxb/eru517 - Transcriptome and metabolome reprogramming in Vitis vinifera cv. Trincadeira berries upon infection with Botrytis cinerea.

The first combined analysis of the transcriptome and metabolome associated with fungal infection. The results provided evidence of a reprogramming of carbohydrate and lipid metabolisms towards increased synthesis of secondary metabolites involved in plant defence, such as trans-resveratrol and gallic acid, compounds that have also an impact on human health. The study provided also metabolic biomarkers of infection that alone or in combination can be used to monitor pathogen infection early in the vineyard.

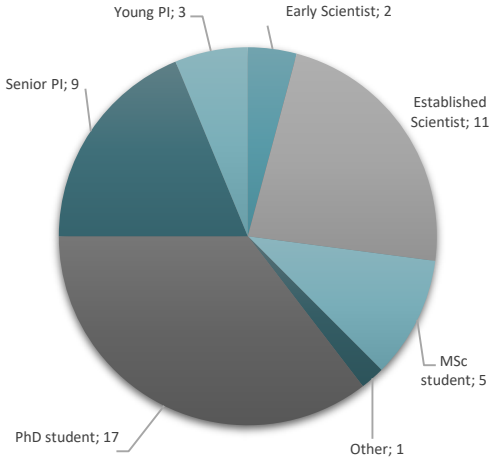
3. Scientific Reports, 2015, 7, 10368 doi: 10.1093/jxb/eru517 - Role of floral organ identity genes in the development of unisexual flowers of Quercus suber L.

The temporal expression of ABCDE MADS-box genes was found to be sex-biased resulting in unusual protein-protein interactions suggest. This study was a major step towards the characterisation of the mechanisms involved in reproductive organ identity in a monoecious tree with a potential contribution towards the knowledge of conserved developmental mechanisms in other species with a similar sex habit.

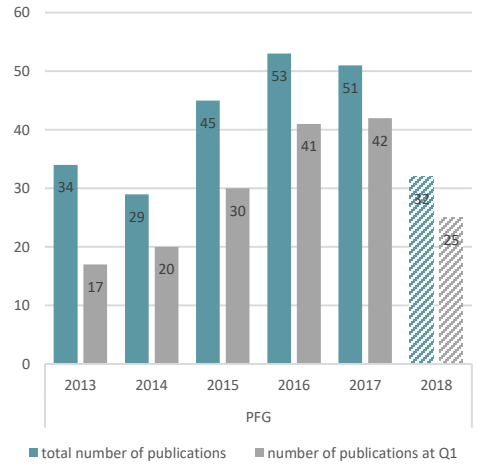
Group Leader: Rui Malhó

Scope: Signalling perception & transduction in apical growing cells
Nº pub 2013-17: 11
Publications: New Phytologist, Plant Physiology and Frontiers Pl Sci.
Nº grants 2013-17: 5 (180k €)
Funding agencies: FCT [1]

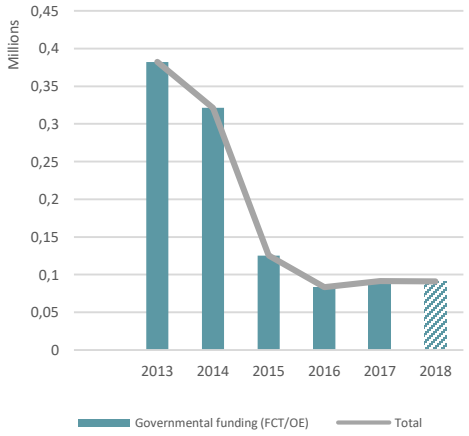
Group member distribution



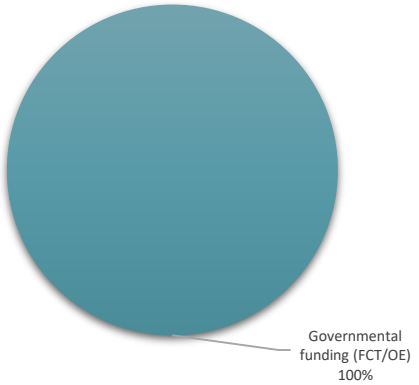
Peer review publications per year



Funding per year



Funding sources (2013-2018)



Senior PIs

Célia Miguel

Scope: Plant secondary growth and embryogenesis, biotic stress
Nº pub 2013-17: 16
Publications: Plant Journal, Plant Biotechnol Journal and Journal of Exp Botany
N grants 2013-17: 6 (839k €)
Funding agencies: EU FP7, EU H2020 and FCT [1]

Paula Lopes

Scope: Food authenticity & Biotic and abiotic stresses
Nº pub 2013-17: 18
Publications: Biosensors and Bioelectronics, Sensors and Actuators B: Chemical and Food Chemistry
N grants 2013-17: 5 (206k €)
Funding agencies: ON2/FEDER, QREN and FCT [1]

Rui Tavares

Scope: Plant stress responses & plant-microbe interactions
Nº pub 2013-17: 12
Publications: Journal of Experimental Botany, Plant Cell and Plant Molecular Biology
Nº grants 2013-17: 7 (191k €)
Funding agencies: FCT [1]

Young PIs

Ana Margarida Fortes

Scope: Fruit ripening and fruit defense against biotrophic and necrotrophic pathogens
Nº pub 2013-17: 16
Publications: J. of Experimental Botany, Sci. Reports and Frontiers Pl Sci.
Nº grants 2013-17: 2 (58k €)
Funding agencies: FCT [1] and Cost Office

Andreia Figueiredo

Scope: Plant-pathogen interactions
Nº pub 2013-17: 15
Publications: Molecular Plant Pathology, Front. Plant Science and Plos One
Nº grants 2013-17: 6 (200k €)
Funding agencies: FCT [1]

Jorge Silva

Scope: Stress effects in photosynthesis and primary production
Nº pub 2013-17: 18
Publications: Plant, Cell and Environment, BMC Ecology,
Nº grants 2013-17: 3 (160k €)
Funding agencies: FCT [1]

FCT - Fundação de Ciência e Tecnologia (PT) [1]

FunGP Group

Functional Genomics & Proteostasis

http://bioisi.pt/fungp/

FunGP unravels disease mechanisms by combining molecular and cell biology with omics and systems-level approaches. The workgroup consists of 6 independent research labs, whose scientific focus coalesce into goals of the Biomedicine TL, albeit contributing to all BioISI activities. Two of the research labs have an international reputation in the competitive field of monogenic disease Cystic Fibrosis (CF), while the other 2 are leaders in signal transduction in cancer and in molecular mechanisms of protein misfolding in neurodegeneration, respectively.

Selected Publications 2013-18:

1. Sci Signal, 2015, 8: ra48. doi: 10.1126/scisignal.aaa1580 - Mechanisms of disease: Cystic Fibrosis (CF), cancer and neurodegeneration

This study (a follow-ap of Moniz et al, ACS Chem Biol 2013; and patent) was very relevant because it unravels the mechanisms of peripheral protein quality control (PPQC) for mutant CFTR (the protein which is dysfunctional in Cystic Fibrosis) by elucidating how activation of the cytoskeletal regulator Rac1 promotes an interaction between the actin-binding adaptor protein ezrin and NHERF1, to stabilize mutant CFTR at the plasma membrane; it is also very interesting because it links the Rho GTPase Rac1 (known for being an important node in signalling networks crucial for tumorigenesis and metastasis) to Cystic Fibrosis, also known to increase cancer propensity

2. Cell, 2013, 154: 1390-400. doi: 10.1016/j.cell.2013.08.045. [Patent also submitted] - Systems approaches to Cystic Fibrosis (CF) and neurodegeneration

This study was important per se because it identified a novel drug target for CF (DGK-iota) using a functional genomics (siRNA screens) approach which revealed global regulators of the sodium channel ENaC, which (besides CFTR) is also dysfunctional in CF leading to major clinical phenotype: dehydration of the airways.

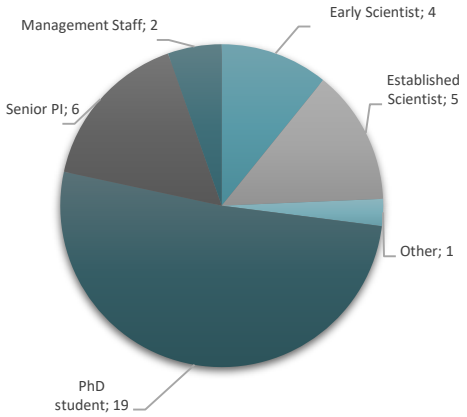
3. E-Biomedicine, 2015, 2: 147-153. doi: 10.1016/j.ebiom.2014.12.005 - Drug development, translational and personalized biomedicine

This paper is important because it bridges the bench (basic science) to the bedside (clinic) by proposing a novel therapeutic strategy through the repurposing of an approved drug (lumacaftor/ ivacaftor, known as OrkambiTM) for the treatment of a rare CFTR mutation (A561E) which occurs in Portuguese patients with Cystic Fibrosis.

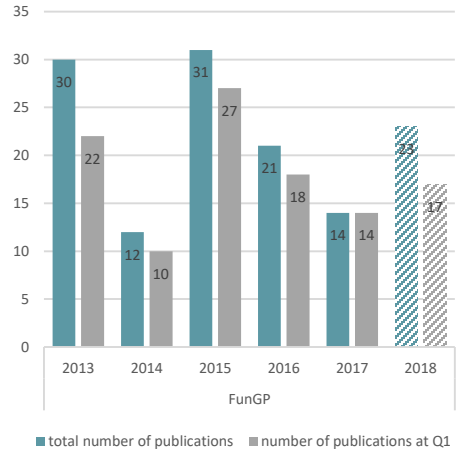
Group Leader: Margarida Amaral

Scope: Systems Biology of Cystic Fibrosis
Nº pub 2013-17: 43
Publications: Cell, Nature Genetics and Chest
Nº grants 2013-17: 14 (1.7 M€)
Funding agencies: FCT[1], Gilead, CFF[2] and European Commission (H2020), Cystic Fibrosis Trust (UK), Vertex Pharmaceuticals and E-RARE

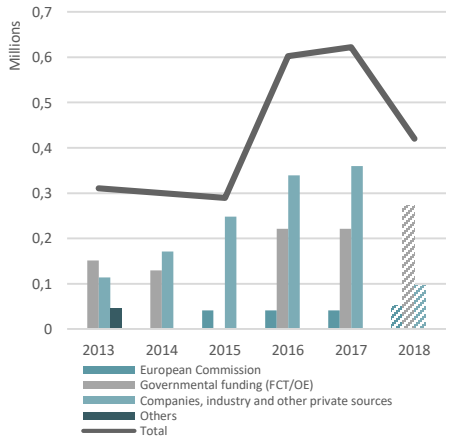
Group member distribution



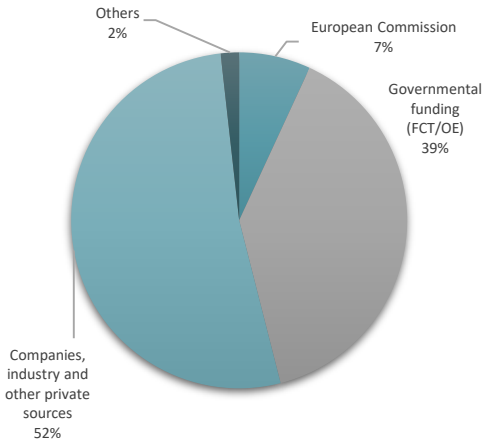
Peer review publications per year



Funding per year



Funding sources (2013-2018)



Senior PIs

Carlos Farinha

Scope: Protein trafficking in Cystic Fibrosis
Nº pub 2013-17: 14
Publications: Cell Chem. Biology, J. of Cell Science and Cell Mol Life Science
N grants 2013-17: 5 (180k €)
Funding agencies: FCT[1], Gilead, CFF[2] and Intramural - BioISI

Cláudio M. Gomes

Scope: Protein folding and molecular mechanisms of misfolding diseases
Nº pub 2013-17: 22
Publications: Angewandte Chem., J. Biological Chem. and F. Mol. Neurosci.
N grants 2013-17: 6 (600k €)
Funding agencies: FCT[1], Fundação Bial, CLIMB and Intramural - BioISI

Paulo Matos

Scope: Signal transduction by RHO GTPases in human disease
Nº pub 2013-17: 13
Publications: Biochim Biophys Acta, Cancer Lett and Science Signal
Nº grants 2013-17: 4 (50k €)
Funding agencies: Gilead, GEDII, SPEDM/Genzyme and Intramural - BioISI

Bárbara Henriques

Scope: Protein misfolding in metabolic disorders
Nº pub 2013-17: 3
Publications: Chemistry & Biology and PLOS One
Nº grants 2013-17: 2 (192k €)
Funding agencies: BioISI[1] e FCT

José Pedro Gil

Scope: Malaria, pharmacology, drug resistance and pharmacogenetics
Nº pub 2013-17: 22
Publications: Lancet, Lancet Infectious Diseases and J. of Infectious Diseases
Nº grants 2013-17: 3 (1390 k €)
Funding agencies: EDCTP, EU-FP6, Vetenskaradet and Aga Khan Develop.ent-FCT/FCG

FCT - Fundação de Ciência e Tecnologia (PT)[1], CFF-Cystic Fibrosis Foundation (US)[2]

M&B Group
Microbiology & Biotechnology

http://bioisi.pt/mb/

M&B focuses on innovative approaches in several areas of M&B and on the establishment of successful and fruitful links with SMEs and industry. M&B-BioISI know-how and expertise represent an integrated knowledge, covering microbial biodiversity and genomics, molecular microbial physiology and ecology, mycology, applied microbiology and biotech applications.
The group adopted the 'rainbow biotech' colours (CHEMIK 2012,66,8,811) to organize the fields of research and adopted a project-oriented organization. Each project is ruled by a PI who reports to GL. This flexible structure copes with changes in team members, societal challenges and industry-academia partnerships, ensuring efficient management, competitiveness and a continuous challenge to excel in research.

Selected Publications 2013-18:

1. Fungal Diversity, 2017, 84: 75-99. DOI: 10.1007/s13225-017-0385-1. -

This paper considers the Dothideomycetes, the largest class of the phylum Ascomycota with 32 orders, to establish ages at which the orders separated and thus establish divergence times of families. It was based on a multi-locus data set (LSU, SSU, TEF1 and RPB2) from 391 taxa and used fossil calibration points solely from within the Ascomycetes. This paper provides an updated phylogenetic assessment of orders and families of Dothideomycetes with divergence times and establishes a standardized taxonomic system that can be followed in future studies on higher level taxonomies of Fungi.

2. Microb Cell Fact. 2015 Aug 28;14:124. doi: 10.1186/s12934-015-0318-1.

The starting point of this study was a previous work (Lage et al 2014) providing evidences that the presence of *Hansenula guilliermondii* modulates *Saccharomyces cerevisiae* growth and fermentative behavior and contributes for higher fruity and floral wine aromas. In this paper, analysis of *S. cerevisiae* transcriptome in mixed fermentations revealed the role of *H. guilliermondii* metabolic activity in changing nutrient availability and thus dramatically influencing expression patterns of various flavor-active compounds associated genes, which could underlie differences on wine aroma profiles. This was the first study focused on elucidation at the molecular level of this yeast–yeast interaction, opening the road for a rationale development of mixed yeast blends for winemaking.

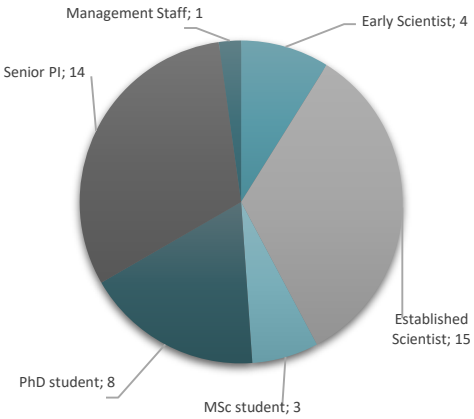
3. Biochim Biophys Acta - Gene Regulatory Mechanisms, 2017, 1860: 773-781. DOI: 10.1016/j.bbagrm.2017.04.005.

Stimuli-responsive transcriptional networks (STN) involves different intracellular structural components as well as folding to converge/diverge stimuli into transcription. Our work links cytoskeleton associated components with STN but with distinct functions in each intracelullar compartment. By exploiting the know-how on STN, a set of yeast genetic tools was developed to screen stress/drug effects based on transcriptional read-outs. Drug responsive transcription networks are multiple and our work raises a new conceptual platform to interpret STN, drug resistance and cross-resistance.

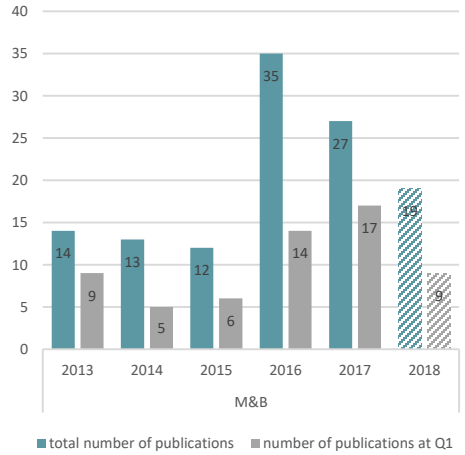
Group Leader: Rogério Tenreiro

Scope: Microbiology and Biotechnology
Nº pub 2013-17: 11
Publications: Marine Drugs, BMC Genomics and Veterinary Microbiology
Nº grants 2013-17: 11 (6.47 M €)
Funding agencies: COMPETE , QREN, FEDER, PORLisboa, MAR2020 and FCT/MCTES[1]

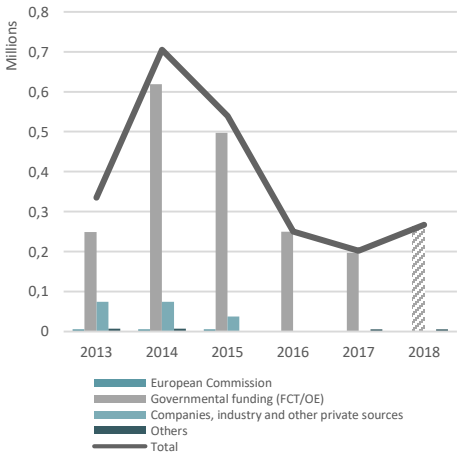
Group member distribution



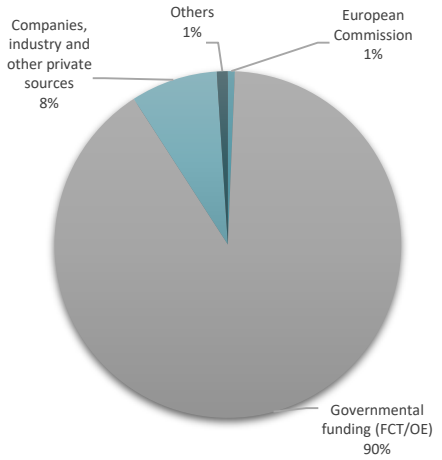
Peer review publications per year



Funding per year



Funding sources (2013-2018)



Senior PIs

Alan Phillips

Scope: Mycology: Systematics & phylogenetics of plant pathogenic ascomycetes
Nº pub 2013-17: 64
Publications: Fungal Diversity and Studies in Mycology
N grants 2013-17: 1 (81k €)
Funding agencies: FCT/MCTES[1]

Arlete Faia

Scope: Microbiology & biochemistry of food and wine fermentations
Nº pub 2013-17: 14
Publications: Appl Microbiol Biotechnol, Food Microb. and Microb Cell Fact
N grants 2013-17: 2 (721k €)
Funding agencies: COMPETE, QREN, FEDER, ON.2-Novo Norte, PORLisboa, FCT/MCTES[1]

Líbia Zé-Zé

Scope: Molecular biology of vector-borne viruses
Nº pub 2013-17: 17
Publications: EuroSurveillance Transactions of the Royal Society of Tropical Medicine and Hygiene
Nº grants 2013-17: 4 (587 k €)
Funding agencies: FCT/MCTES[1]

Alexandra Mendes Ferreira

Scope: Omic tools in the study of the biology of wine yeasts
Nº pub 2013-17: 12
Publications: PLOS One, Microb Cell Fact and Food Microbiology
Nº grants 2013-17: 8 (9160 k €)
Funding agencies: COMPETE, QREN, FEDER, NORTE_2020, ON.2-Novo Norte, PORLisboa and FCT/MCTES[1]

Leonor Cruz

Scope: Plant-bacteria pathosystems
Nº pub 2013-17: 6
Publications: Plant Pathology and European Journal of Plant Pathology
Nº grants 2013-17: 7 (68500k €)
Funding agencies: FEDER,PRODER, EU and FCT/MCTES[1]

Ricardo Dias

Scope: Data mining on genomic dark-matter from microbial origin
Nº pub 2013-17: 9
Publications: Frontiers in Microbiology and BMC Genomics
Nº grants 2013-17: 3 (1200k €)
Funding agencies: COMPETE2020, PORLisboa, FCT/MCTES[1] and Private funding

FCT - Fundação de Ciência e Tecnologia (PT)[1]

BTR Group

Biomedical and Translational Research

http://bioisi.pt/btr/

BTR's main question is how biological factors, lifestyle and the environment interact to influence health, disease and treatment. BTR consists in several research teams that employ common approaches (large population datasets, genomics, integrative data analysis) to investigate human traits or diseases, including autism spectrum disorders, cardiovascular and metabolic diseases, hearing loss, sickle cell disease, therapeutic response.

Selected Publications 2013-18:

1. J Am Coll Cardiol. 2015 Nov 10;66(19):2152-4. doi: 10.1016/j.jacc.2015.08.871. Familial Hypercholesterolaemia (FH) is the genetic disorder of lipid metabolism associated with an increase risk of coronary heart diseases. This work presents the characterization of the first homozygous patient with FH due to two PCSK9 mutations and its characterization showing the mechanisms of disease and patient response to different treatments. This paper also enlarges the mutational spectrum of the disorder and demonstrates the importance of the functional characterization to prove pathogenicity, as has also been shown in Alves et al, 2014, Benito-Vicente A et al, 2015, Medeiros AM et al 2015 and Alves et al, 2018.

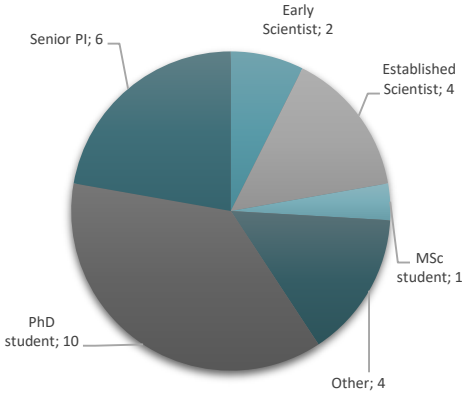
2. Journal of Clinical Lipidology 2017, Mar - Apr;11(2):477-484.e2. doi: 10.1016/j.jacl.2016.11.002. This paper shows evidence towards the need to identify the etiology of the dyslipidaemia in patients with a clinical phenotype of familial hypercholesterolaemia (FH) since it is necessary to known exactly the pathway affected to select the correct therapy for the best patient prognosis. It also provides evidence for the need for the implementation of a personalized medicine for FH patients.

3. Am J Hum Genet. 2014 May 1;94(5):677-94. doi: 10.1016/j.ajhg.2014.03.018. This paper demonstrated the relevance of rare structural variants for Autism Spectrum Disorder etiology and highlighted cellular pathways and gene networks involved in this disorder, showing the need to employ systems biology approaches to extract the full biological meaning of large scale genetic data, as later supported in Correia et al, PLOS ONE 2014 and more recently in Asif M, A systems medicine approach to study Autism Spectrum Disorder based on genomic and clinical data (BioSys PhD thesis completed). The paper further illustrated the need for very large datasets to discover genetic factors underlying autism, recruited through scientific consortia; it thus paved the way to the analysis of the shared genetic contributions among neuropsychiatric and neurological disorders, as later reported in the following publications: Maier et al, AJHG 2015 Feb 5;96(2):283-94; ASD Working Group of PGC et al Mol Autism 2017 May 22;8:21; Weiner et al Nat Genet 2017; and Brainstorm Consortium, Science 2018 Jun 22;360(6395). These articles have uncovered shared genetic factors contributing to multiple brain disorders, questioning some aspects of nosological definitions and with eventual implications for drug discovery and therapeutic intervention. Overall, this body of work makes clear the need to integrate clinical information with genetic data across neuropsychiatric disorders to generate tools of clinical utility in diagnosis, disease classification and effective intervention.

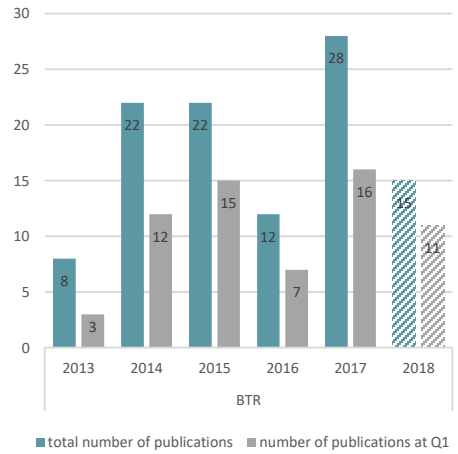
Group Leader: Astrid Moura Vicente

Scope: Systems medicine for complex disorders
Nº pub 2013-17: 21
Publications: Science, Neurology and Nature Genetics
Nº grants 2013-17: 10 (837k €)
Funding agencies: FCT[1], Portugal 2020, ASF[2], FCG[3], COST[4] and European Commission (DG-SANCO)

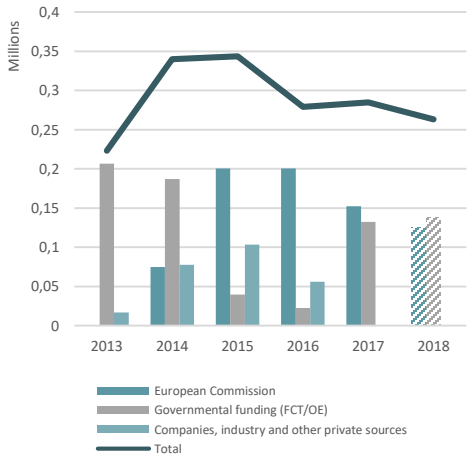
Group member distribution



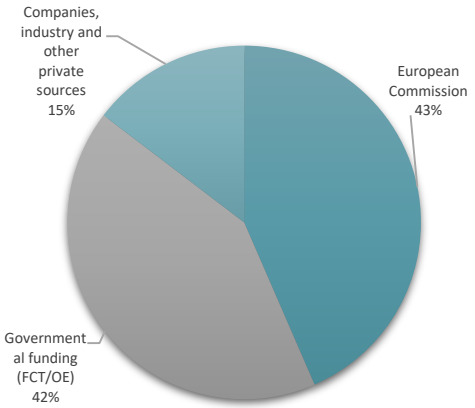
Peer review publications per year



Funding per year



Funding sources (2013-2018)



Senior PIs

Mafalda Bourbon

Scope: Familar Dislipidemias
Nº pub 2013-17: 25
Publications: JACC, Circulation: Gentics in Medicine and Cardiovascular Genetics
Nº grants 2013-17: 4 (461051€)
Funding agencies: FCT[1]

Helena Caria

Scope: Herediatry deafness
Nº pub 2013-17: 12
Publications: Int J Ped. Otorhinolaryngoly, OMICS and Gene
Nº grants 2013-17: 3
Funding agencies: FCT[1]/Ear Foundation, UK/Sociedade Portuguesa de Pediatria

João Lavinha

Scope: Pathology and molecular epidemiology of globins in the Portuguese population
Nº pub 2013-17: 12
Publications: PLoS One, Immunogenetics and European J. of Haematology
Nº grants 2013-17: 0
Funding agencies: none

Luciana Costa

Scope: Health promotion and disease prevention
Nº pub 2013-17: 5
Publications: Neurobiology of Aging
Nº grants 2013-17: 1 (68k €)
Funding agencies: European Commission

Luísa Mota-Vieira

Scope: Molecular diagnosis of genetic and infectious diseases
Nº pub 2013-17: 18
Publications: PLoS One and Molecular Carcinogenesis
Nº grants 2013-17: 0
Funding agencies: none

FCT - Fundação de Ciência e Tecnologia[1], ASF-Autism Science Foundation[2], FCG - Fundação Calouste Gulbenkian[3], COST - European Cooperation in Science and Technology[4]

GER Group
Gene Expression and Regulation

http://bioisi.pt/ger

GER comprises 5 labs exploring molecular mechanisms and global regulation of eukaryotic genomes and gene expression programs, with a focus on human health and disease. Three labs take a predominantly experimental approach to mechanisms and regulation, while 2 teams rely more on transcriptomics, bioinformatics, computational and network biology to address systems level events. GER research thus primarily integrates within BioMed and BioInf TLs. All teams actively engage in collaborative work, synergizing their complementary expertise, generating critical mass for enhanced research capacity.

Selected Publications 2013-18:

1. Nucleic Acids Res., 2015, 43(13):6528-44. doi: 10.1093/nar/gkv588 – Mechanisms and models of gene expression

This study explains the ´AUG-proximity effect´ whereby some mRNAs harboring premature termination codons are resistant to decay. It reshapes the field senior thinking on mechanisms controlling the decay of PTC containing transcripts, providing a novel model for nonsense-mediated mRNA decay defining the determinants and exact boundary of AUG-proximity protection, with potential therapeutic applications to the targeting of truncated proteins in hereditary diseases and cancer.

2. Hum Mol Genet, 2013, 22(1):84-95. doi: 10.1093/hmg/dds405 – Global misregulation of gene expression: cancer & neurodegeneration

This work provides the first mechanistic evidence for a tumor-suppressing role of WNK2 related to Rac1 signaling and tumor cell invasion and proliferation in adult gliomas. The work paved the way to our follow-up studies into the role of Rac1 signaling in cancer, including that of a splicing variant, Rac1b, overexpressed in a subgroup of colorectal tumors. Our later observation that Rac1b overexpression is specifically and efficiently inhibited by ibuprofen suggests unsuspected benefits from its use in the treatment of serrated colorectal tumors or inflammatory colon syndromes.

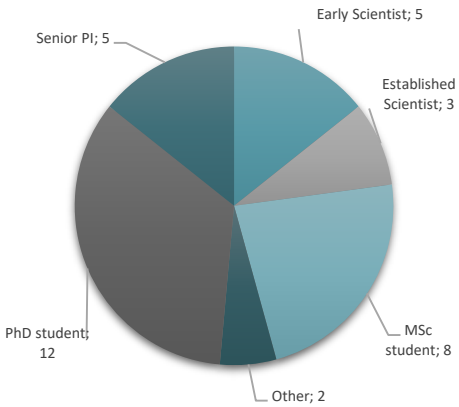
3. EMBO J., 2017, 36(3):346-360. doi: 10.15252/embj.201694335 - The non-coding genome in health and disease

This study identifies novel microRNA regulators connecting naïve CD4+ T cell activation to HIV replication based on a systematic NGS profiling of human primary cells. We show for the first time the transcriptional up-regulation of miR-34c-5p in response to TCR stimulation and its concurrent inhibition in response to HIV-1 and HIV-2 infection, which we propose is part of an anti-viral host response that can be potentially harnessed for therapeutic purposes, given our demonstration that increased miR-34c-5p levels promote HIV replication.

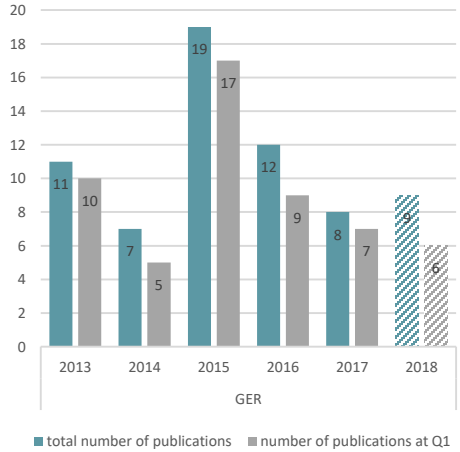
Group Leader: Margarida Gama-Carvalho

Scope: RNA Biology and Transcriptomics
Nº pub 2013-17: 12
Publications: EMBO Journal and Immunity
Nº grants 2013-17: 4 (238k €)
Funding agencies: FCT,[1] JPND,[2] EU and BioISI

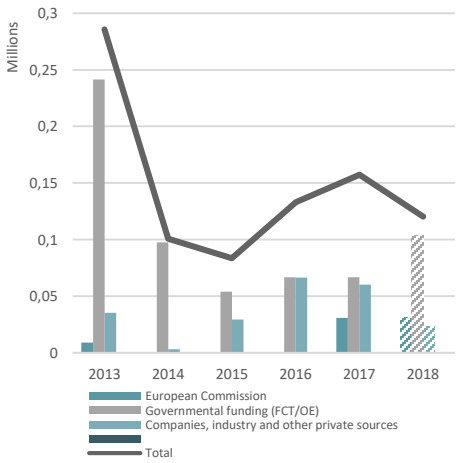
Group member distribution



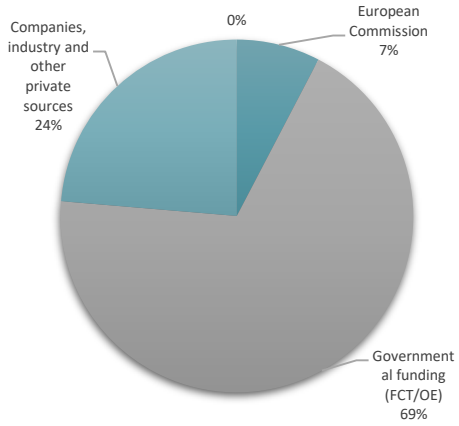
Peer review publications per year



Funding per year



Funding sources (2013-2018)



Senior PIs

Francisco R. Pinto

Scope: Computational Biology of Regulatory Networks
Nº pub 2013-17: 8
Publications: Journal of Hematology & Oncology
N grants 2013-17: 1 (89k €)
Funding agencies: FCT[1]

Luísa Romão

Scope: Mechanisms of translational control and mRNA surveillance in health and disease
Nº pub 2013-17: 9
Publications: PLOS Genetics, Cell. and Mol. Life Sci. and Nuc. Acids Research
Nº grants 2013-17: 3 (219624 €)
Funding agencies: FCT,[1] Merck Sharp and Dohme

Peter Jordan

Scope: Cell signalling
Nº pub 2013-17: 13
Publications: Human Molecular Genetics, RNA and BBA-Rev Cancer
N grants 2013-17: 6 (160k €)
Funding agencies: FCT,[1] BioISI, Maratona Saude and GEDII

Raquel Chaves

Scope: Chromosome Biology and Repetitive Sequences
Nº pub 2013-17: 15
Publications: Genome Biology and Evolution, Molecular Phylogenetics and Evolution, Chromosome Research
Nº grants 2013-17: 2 (110k €)
Funding agencies: ON2 FEDER and EU

FCT - Fundação de Ciência e Tecnologia (PT),[1] JPND - Neurodegenerative Disease Research [2]

CBS Group

Chemistry for Biological Systems

http://bioisi.pt/Cbs

CBS aims at developing new molecules and materials, studying how they interact with each other, the environment, and biological systems. We also seek to understand the bioenergetic metabolism of prokaryotes, with emphasis on pathogens, by combining molecular and cellular experimental methodologies with computational approaches. CBS is organized in 4 independent labs contributing mainly to BChem TL and sharing research interests with several groups and TLs.

Selected Publications 2013-18:

1. Chem. Sci., 2016,7, 4251-4258 [DOI: 10.1039/C5SC04577K]
This work reports the first example of a compound displaying spin crossover, phenomenon with huge potential for application in spintronics and sensor devices, and the thermosalient effect, phenomenon related to thermal-activated motion of crystals with application in actuator devices. This resulting hybrid material (magnetic memory and thermal-activated motion) opens doors on the application and development of spin crossover materials. With this report, the field of spin crossover gained awareness for the new coming systems and momentum to revisit old unreported systems. The materials scientists also gained new hybrid materials to apply into the fabrication of new devices. It is now common to verify the thermosalient phenomenon in various spin crossover research labs.

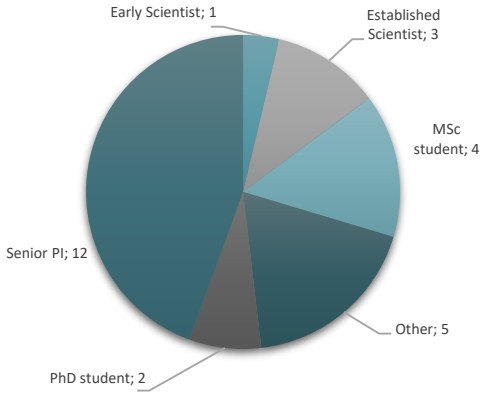
2. J. Chem. Theory Comput., 2016, 12 (3), pp 930–934 doi: 10.1021/acs.jctc.5b01114
In this paper, we used a state-of-the-art constant-pH MD method to study for the first time the proton binding affinity of model peptides exhibiting one of the pH active amino acids. This pioneer work provided valuable data on the pKa profiles for each amino acid and a very good estimation of the pKa shift each residue undergo when inserting into a lipid bilayer. This in silico approach is particularly useful to the scientific community since the data it provides is currently still inaccessible using experimental techniques.

3. Mol. Micro.98, 272-288 doi: 10.1111/mmi.13120
We explored NDH-2, a protein involved in the energetic metabolism of S.aureus, a worldwide problem in clinical medicine. NDHs-2 are recognized as potentials targets for novel antimicrobial therapies. We obtained its crystal and solution structures, showing that it is a dimer in solution. We analyzed protein-substrate interactions by fluorescence and STD-NMR spectroscopies, which indicate that NADH and the quinone bind to different sites. We performed fast kinetic analyses of the protein and detected a charge-transfer complex formed between NAD+ and the reduced flavin, which is dissociated by the quinone. it provides is currently still inaccessible using experimental techniques.

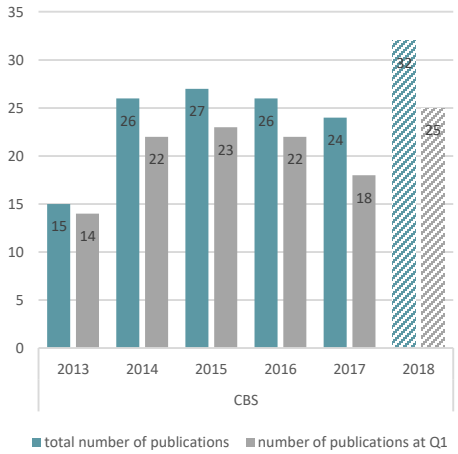
Group Leader: Maria José Calhorda

Scope: Inorganic and computational chemistry
Nº pub 2013-17: 48
Publications: Chemical Science, Chemistry European Journal and ACS Catalysis
Nº grants 2013-17: 1 (16200 €)
Funding agencies: FCT [1]

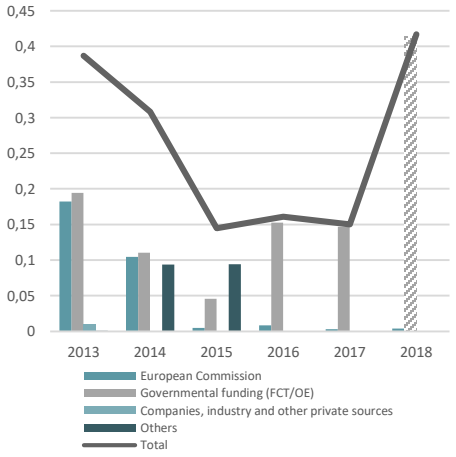
Group member distribution



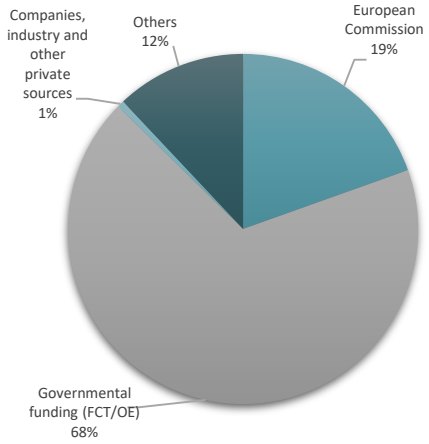
Peer review publications per year



Funding per year



Funding sources (2013-2018)



Senior PIs

Manuela M. Pereira

Scope: Bioenergetics
Nº pub 2013-17: 14
Publications: Mol. Micro.,Biochim Biophys Acta – Bioenergetics and Environ Microbiol.
N grants 2013-17: 4 (274k €)
Funding agencies: FCT[1], UE and COST [2]

Paulo Costa

Scope: Computational methods and simulation in molecular recognition
Nº pub 2013-17: 18
Publications: Angew. Chem. Int. Ed., Chem. Sci. and J. Med. Chem.
Nº grants 2013-17: 2 (50 k €)
Funding agencies: FCT[1]

Mª Luísa Serralheiro

Scope: Bioactivity of beverages
Nº pub 2013-17: 23
Publications: Food & Function, Journal of Ethnopharmacology
N grants 2013-17: 0
Funding agencies: 0

Miguel Machuqueiro

Scope: Molecular modeling and simulation of pH effects in biomolecules
Nº pub 2013-17: 26
Publications: J. Chem. Theory Comput., Macromolecules and J. Med. Chem.
Nº grants 2013-17: 4 (163005 €)
Funding agencies: FCT[1] and EU

Helena Gaspar

Scope: Discovery of new bioactive natural products and new recreative drugs
Nº pub 2013-17: 7
Publications: Archives Toxicology
Nº grants 2013-17:4 (439054 €)
Funding agencies: FCT[1] and Adi

Paulo Martinho

Scope: Multifunctional Hybrid Systems
Nº pub 2013-17: 11
Publications: ACS Nano, Chemical Science and Dalton Transactions
Nº grants 2013-17: 2 (201879 €)
Funding agencies: ICG and FCT [1]

FCT - Fundação de Ciência e Tecnologia (PT)[1] and European Cooperation in Science and Technology[2]

Bio-PhysNano Group

Bio-Physics & Nanosystems

http://bioisi.pt/biophysnano/

The main goal of the Bio-PhysNano is to understand and to improve the characterization of biosystems by studying them as physical systems, and to develop adequate instrumentation and theoretical tools. The group comprises 2 teams:

- MagNano (Magnetism & Nanosystems) is a team with a large experience in magnetism, electronic/atomic configuration studies and in the development of nanotechnology methods and techniques, recently focused on biological systems and applications
- PBS (Physics of Biological Systems) was created in 2008 as the first FCT research group in physics of biological systems, with protein physics as its major focus. On-going research includes other topics in complex systems, using analytic and computational methods rooted in statistical or quantum physics

Selected Publications 2013-18:

1. J.Solid State Chem. 2013, 201, 144-152 [10.1016/j.jssc.2013.02.024] **; RSC Advances, 6, 77, 2016, 73506-73516 [**10.1039/c6ra13818g**]**
Using information from high resolution magnetic techniques a rapport composition-size for iron oxide chemically synthesized nanoparticles was identified. Iron oxide nanoparticles (7 nm< d <20 nm) were described as Fe3-xO4 (x decreasing with increasing d) and shown compatible with a core-shell structure model were a magnetite core is surrounded by an oxidized magnetite layer (maghemite), the core dimension depending on particle size. Natural templates were used to induce organization of magnetic nanoparticles leading to an increased heating efficiency of the system determined by ac magnetic induction measurements. Both issues are determinant in the frame of magnetic hyperthermia cancer therapy applications.

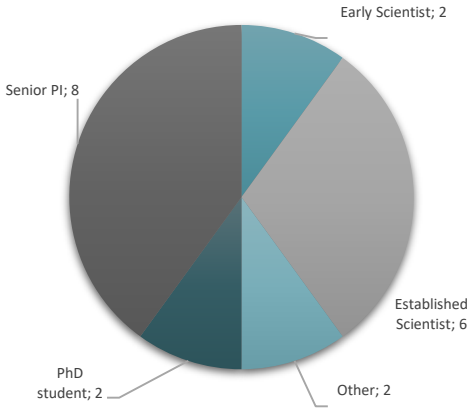
2. PLoS ONE 9(7): e101687, 2014 doi.org/10.1371/journal.pone.0101687
Using a Force Feedback Microscope (FFM) - Patent: Device for measuring an atomic force, Mário S Rodrigues et al, WO 2013057426 A1 , 2013 – the PC12 cell membrane mechanical response was found to be frequency dependent in 1-10kHz range with a damping coefficient consistently decreasing with increased excitation frequency. In contrast with conventional dynamic AFM techniques, in FFM approach the tip excitation frequency can be arbitrarily chosen, leading to new spectroscopic techniques. This work illustrates one important advantage of the FFM technique .

3. PLoS Comput Biol. 10(5): e1003606, 2014, 10.1371/journal.pcbi.1003606
This work brings together folding and docking simulations to provide a microscopic rationale for the in vitro amyloidogenic behaviour of beta-2-microglobulin (wild type and DN6 variant), the causing agent of dyalisis related amyloidosis.

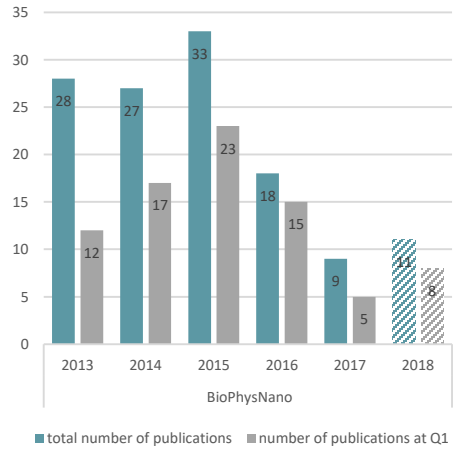
Group Leader: Margarida Godinho

Scope: Nano - structured magnetic systems
Nº pub 2013-17: 19
Publications: Journal of Applied Physics
Nº grants 2013-17: 1 (296k €)
Funding agencies: FCT (Infrast) [1]

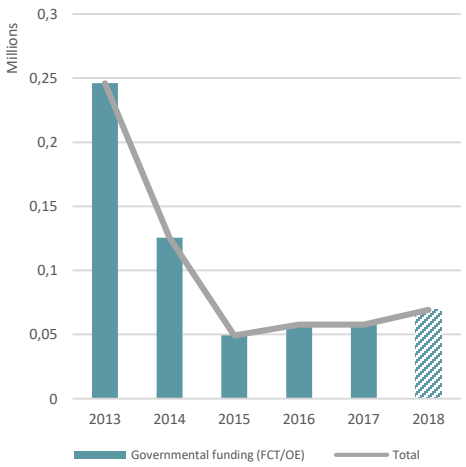
Group member distribution



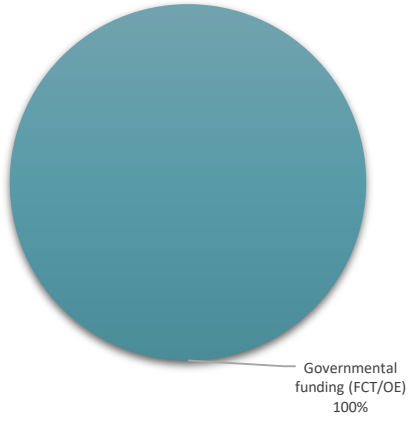
Peer review publications per year



Funding per year



Funding sources (2013-2018)



Senior PIs

Patrícia Faísca

Scope: Physics of protein folding and aggregation
Nº pub 2013-17: 12
Publications: J. of Molecular Biology; PLoS Comp. Biology and Phys. Chem.
Nº grants 2013-17: 3 (240k€)
Funding agencies: FCT

Margarida Cruz

Scope: Magnetic Nano-structures
Nº pub 2013-17: 19
Publications: J. Alloys & Comp and J. Applied Phys.
N grants 2013-17: 0
Funding agencies: none

Ana Nunes

Scope: Physics of Complex Systems
Nº pub 2013-17: 7
Publications: J. Theor Biol, Phys Review E and Virulence
Nº grants 2013-17: 0
Funding agencies: none

Liliana Ferreira

Scope: Molecular Complexes and Magnetic Nano-structures
Nº pub 2013-17: 23
Publications: Chemical Science, Journal of Materials Chemistry C
Nº grants 2013-17: 0
Funding agencies: none

Benedito Cabral

Scope: Dynamics & Elect Prop. of Complex Systems
Nº pub 2013-17: 15
Publications: J. ChemPhys, J.Phys Chem B and Adv in Q. Chem.
Nº grants 2013-17: 3 (140k€)
Funding agencies: FAPESP and CNPQ CAPES

Young PIs

Mário Rodrigues

Scope: Physics at the nanoscale and nanotechnology
Nº pub 2013-17: 12
Publications: Scient Reports and J. Applied Physics
N grants 2013-17: 2 (200k €)
Funding agencies: FCT[1]

FCT - Fundação de Ciência e Tecnologia (PT)[1]

MAS Group
Agent and Systems Modelling

http://bioisi.pt/mas/

MAS carries out research in Artificial Intelligence (AI) in general, including machine learning and visualization. A strong focus is on agent-based approaches and exploring links between biology and physics with AI, self-organized systems and bio-inspired computation. Two specific research areas (sub-groups) are: social simulation (GUESS), and computational artificial life (GruVA).

Selected Publications 2013-18:

1. Artif Intelligence, 2015, 229:175-199 doi:10.1016/j.artint.2015.08.003 & Int J Intell Syst, 2016, 31: 106-127 doi.org/10.1002/int.21747

Multi-agent models of power and leadership were developed for human societies and their organisations. This produced an approach to model structured agent societies with context permeability across multiple coexisting social networks [Nunes D, Antunes L (2015) Modelling structured societies: A multi-relational approach to context permeability.] and a model of self-organised demonstrations and their behaviour [Lemos C, Lopes RJ, Coelho H (2016), On Legitimacy Feedback Mechanisms in Agent-Based Modeling of Civil Violence. Int J Intell Syst, 31: 106-127]

2. Silva et al, Royal Society open science 2017

An evolutionary approach was developed to build online robot controllers based on artificial neural networks, for robotic swarms. This work was applied in simulation and in real robots and it was an original achievement since no previous solution existed for online development of robotic swarm controllers

3. Gomes et al, IEEE Trans Evol Comput 2017

Development of new cooperative coevolutionary algorithms for the synthesis of controllers for heterogeneous multiagent systems. The proposed algorithms were evaluated in simulated agents and real robots, and were shown to overcome fundamental limitations in this class of evolutionary algorithms. This work established cooperative coevolution as a promising approach for evolving cooperative multiagent systems

4. Evolutionary Computation, 2016, 24(2):205-236. doi: 10.1162/EVCO_a_00172

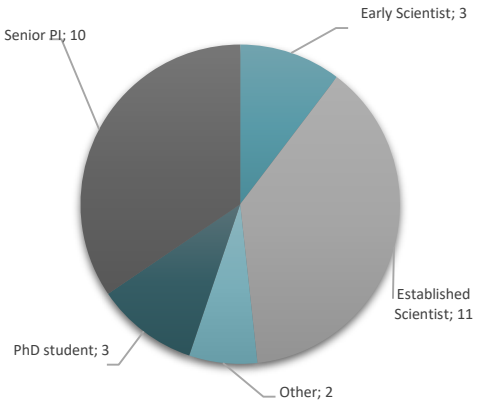
A review and discussion of open issues in evolutionary robotics with analysis of promising research approaches was published with the goal of contributing to the establishment of evolutionary robotics as a canonical approach for the engineering of autonomous robots. This article received the Best of Computing 2016 award, by ACM Computing Reviews

All h-index from google scholar

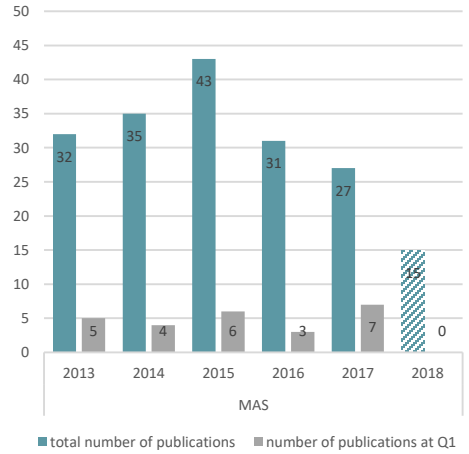
Group Leader: Luís Correia

Scope: Artificial Life, Self-organisation, mobile robots
Nº pub 2013-17: 40
Publications: Royal Society open science, Evolutionary Computation and Applied Soft Computing
Nº grants 2013-17: 2 (520k €)
Funding agencies: FCT [1] and EU

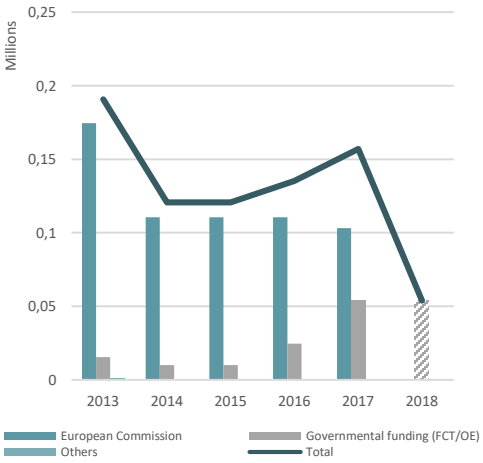
Group member distribution



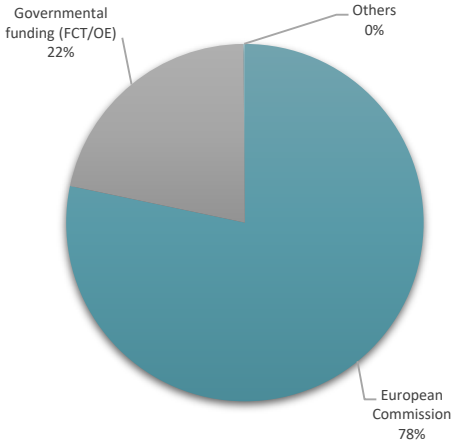
Peer review publications per year



Funding per year



Funding sources (2013-2018)



Senior PIs

Ana Paula Cláudio

Scope: Computer Graphics; Serious Games; Virtual and Augmented Reality
Nº pub 2013-17: 44
Publications: Virtual Archaeology Review; International Journal of Clinical Pharmacy and International Journal of Pervasive
Nº grants 2013-17: 1 (15k €)
Funding agencies: FCT [1] and EU

Helder Coelho

Scope: Machine prediction
Nº pub 2013-17: 44
Publications: International Journal of Intelligent Systems
Nº grants 2013-17: 0
Funding agencies: none

Luís Antunes

Scope: Social Simulation, Multi-agent Systems, Artificial Intellicence
Nº pub 2013-17: 24
Publications: Artificial Intelligence and JASSS
N grants 2013-17: 0
Funding agencies: none

Beatriz Carmo

Scope: Visualization, Virtual & Augmented Reality, Computer Graphics
Nº pub 2013-17: 47
Publications: Virtual Archaeology Review, International Journal of Pervasive and Computing and Communications
Nº grants 2013-17: 1 (45.704€)
Funding agencies: FCT [1]

Luís Cavique

Scope: Data mining, data reduction, heuristic optimization
Nº pub 2013-17: 8
Publications: Social Network Analysis and Mining, Expert Systems
Nº grants 2013-17: 0
Funding agencies: none

Paulo Trigo

Scope: Multi-agent Decision-Making; Semi-Markov Decision Process
Nº pub 2013-17: 15
Publications: Eurasian J. Mathematical and Computer App.
Nº grants 2013-17: 0
Funding agencies: none

[1] FCT - Fundação de Ciência e Tecnologia (PT)

At BioISI facilities are an important instrument to recruit the most talented young scientists and significantly contribute to advanced training: PhD, MSc students, workshops. In 2018-2022, resources will be applied to maintain, update, and support BioISI facilities with expert staff, so that their usage can be applied to maximize expertise and technologies to solve specific biological problems.

Main Goals:

1. Providing excellent services with state-of-the-art equipment, user support and appropriate computational infrastructure;
2. Turning BioISI into a key player in the operation of the next generation of biological research infrastructures within ULisboa;
3. Open labs to society initiatives (FabLabs as proposed by the PRP-National Reform Plan for Portugal) by which citizens, companies, researchers and public institutions work together (in co-creation) to innovate faster and more effectively.

BioImaging

BioISI BioImaging facility is part of FCUL Microscopy Facility, a research and academic infrastructure that functions as a service provider and technical support hub for Research Units and teaching staff, as well as the rest of the scientific and student communities.

Its main areas of operation are:

1. Research: microscopy services for in-house, as well as external Research Units
2. Academia: bioimaging tutoring and facilities for FCUL undergraduate and post-graduate courses.
3. Outreach: “open days” and science communication events for school visits
4. Mentoring: advanced courses and workshops on bioimaging for students and researchers

Technology: confocal microscope | widefield & fluorescence microscopes | fluorescence stereoscope | scanning and transmission electron microscope | high-throughput imaging system.

Technicians: Telmo Nunes | Luís Marques

Computing

In terms of computing and data storage facilities, BioISI has currently installed 408 cores, 1144 GB RAM, and 88 TB storage in equipment concentrated essentially in 4 groups: GER, PBS, M&B, and FunGP.

We have been following an approach of exploiting common facilities available nationwide and at european level, INCD and EGI, respectively. The former is currently operational with an availability for BioISI of 200 virtual CPUs, 870 GB RAM and 5 TB storage.

Genomics

This facility provides services in NGS for both DNA and RNAseq analysis to internal and external users.

These services include:

a) Genome-wide analysis;

b) Transcriptome sequencing

c) Identification of small non-coding RNAs;

The facility provides access to instruments (qPCR, NanoDrop, PCR cyclers) and consulting analysis

Physics

The Atomic Force Microscopy and Related Techniques Laboratory (AFM-RT Laboratory) serves both scientists and students.

There are 3 microscopes: one commercial AFM, one commercial AFM converted into an FFM and one home developed Force Feedback Microscope (FFM). The main activities of this laboratory are:

1. Research
   a) Imaging: protein structures, cells, DNA, surfaces in general
   b) Mechanical properties of cells
   c) Instrumentation: development of new instruments, software and experimental strategies that support our research activity
   d) Study of nanotribology and nanofluidics by AFM and similar techniques
2. Education: AFM training classes for graduate students
3. Outreach: Visits from high school students and displays for the general public.

Proteomics

The recently created Proteomics facility will deliver information on proteins molecular weight and identification through mass spectrometry determination and data-based analysis

Will allow BioISI to be in the top knowledge of cell proteome changes in health and diseases

Will allow the identification of cell-drug targets

Protein Core (proposed)

Will bring BioISI to the forefront of protein research and biomolecular interactions

Grounded on existing solid expertise on protein biophysics and structural biochemistry - scientific, technical and management

Will assemble new instrumentation for protein purification, analysis of protein size, shape, interactions, ligand-binding and complex formation

Will foster advances in applications and engage in training through participation in international technological consortia

Plant House

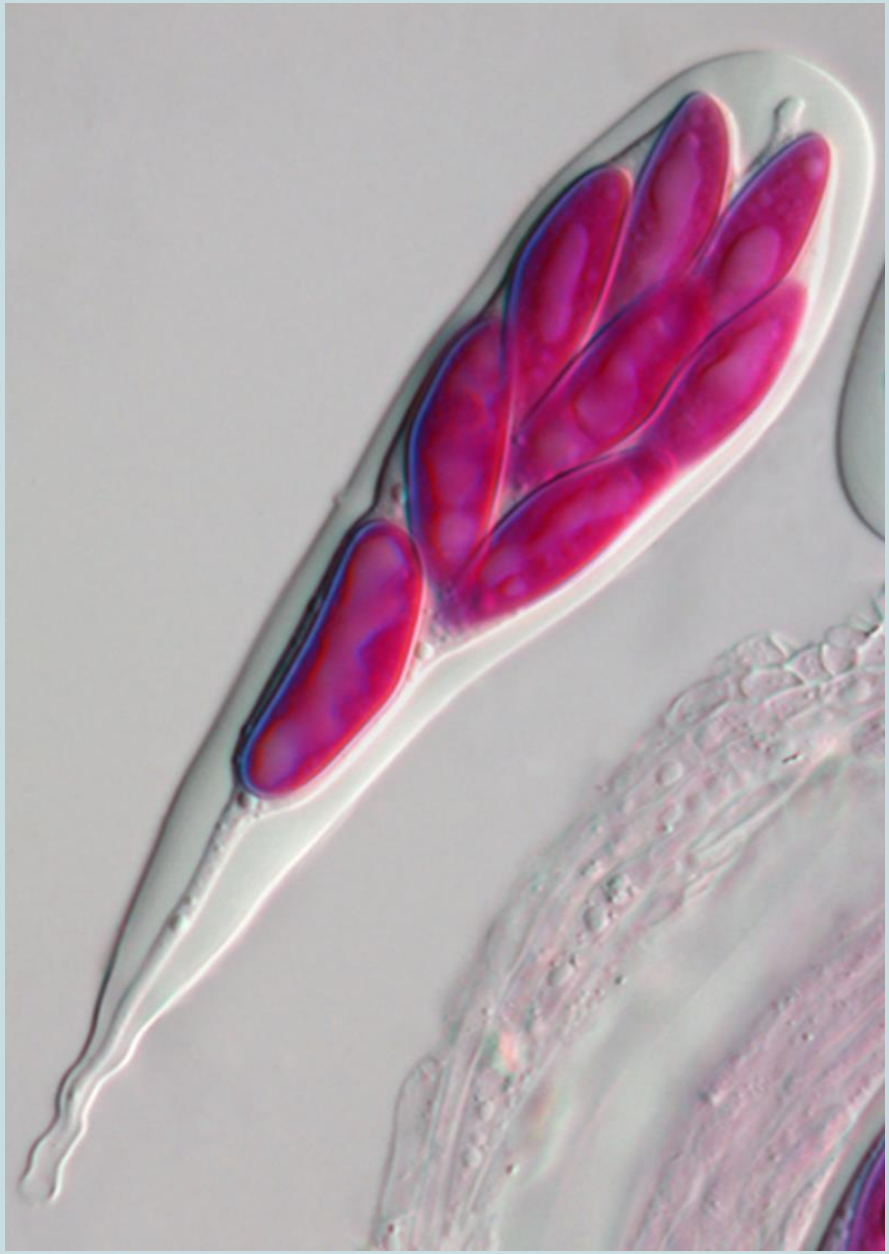
The Plant House Facility has specialized plant growth chambers and provides support to research groups.

Several chambers are capable of providing stressful environmental conditions i.e. low temperature (chilling), high temperature, different light intensities and different relative humidity, allowing precise environmental simulation across different climate zones.

Mammalian Cell Culture

This facility provides expertise and advice in advanced methodologies for mammalian cell culture. Mammalian cell culture facility services include:

a) Expert consultation for researchers regarding primary cultures of human cells and organoids;
b) General cell culture (media and experimental design);
c) Large-scale production of cells;
d) Cryopreservation of cell lines;
e) Mycoplasma screening;
f) Training in usage of environmental and safety of laminar flow hoods, incubators, cell seeder and microporator.



BioISI SWOT Analysis

STRENGTHS

- Collaborative environment and **interdisciplinary competences** required for Systems Biology
- **Outputs of excellence** (publications, patents, PhD & MSc theses).
- Success in securing **competitive funding**.
- Solid collaborations with **industry**.
- High level of **internationalization & networking**.
- Strong commitment to **education and career development programmes.**
- Strong **leadership** and **simple management structure.**
- **Core-facilities** to support research.

Actions

- Increase funds for inter-disciplinary projects:
  - Stimulate interactions
  - Reward productivity and quality.
- Reinforce & update core-facilities.

WEAKNESSES

- Still some **compartmentalization of research areas.**
- Lack of **technical personnel** (staff running facilities).
- Moderate success in **knowledge & technology transfer (KTT).**
- Scarce **international projection**.

Actions

- Stimulate **interdisciplinarity by BioISI projects and hire post-docs with systems approaches skills**.
- **Promote interdisciplinary workshops** at BioISI.
- **Hire post-docs** for BioISI facilities.
- Hire a **KTT** officer.
- Apply to **EU (ESFRIs)/ national networks** 'to extend' facilities.
- Promote **international grant applications**.

OPPORTUNITIES

- Many **funding opportunities**: (H2020 ; P2020; Pharma, etc.)
- National initiatives for **innovation & technology centres** and collaborative laboratories.
- Unmet research needs in some niche industries.
- Privileged access to **top students**: MSc/ PhD
- **Attractiveness** of the Lisboa region.

Actions

- Promote **international grant applications** (e.g. Twinning, ERCs)
- Hire a **project support officer** to **stimulate** further project submission & networking.
- Widen the **scope of interactions** with Industry.
- Strengthen **PhD programme**.
- Create **new early researchers programme (pre-PhD)**.

THREATS

- **Deficient national long-term strategy & uncertainty** in science funding in Portugal.
- **Regionalization** of science funds.
- **Structural dissociation** of Universities and research centres.
- **Lack of scientific careers** to attract/ keep top researchers/ technicians.
- Few Portuguese companies carrying out research.

Actions

- Promote **institutional dialogue**.
- Foster **BioISI poles as leaders** in their regional projects.
- Launch **PostDoc & career development** programs.
- Apply to **Marie Curie training programs**.
- Foster creation of **start-ups** (KTT office).

BioISI Prospective Actions for 2019-22