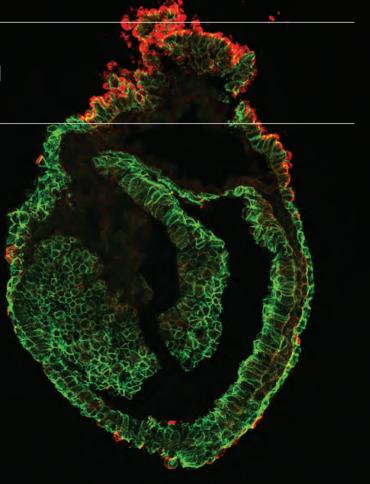
ANNUAL REPORT 2018





COVER IMAGE Confocal image of a section of an embryonic day (E)7.5 mouse embryo, immunostained for E-cadherin (green) and Ror receptor (Red). Credits: Rita Aires and André Dias, IGC.

This Annual Report covers the Instituto Gulbenkian de Ciência's financial year, from 1st January to 31st December 2018

ANNUAL REPORT 2018



- 4 Foreword from the Director
- 8 Organisation
- 10 The IGC at a Glance
- 15 Budget Overview
- 16 A Walk Through 2018
- 24 Some Science Stories from 2018



1 RESEARCH

34 Adrain. Colin Membrane Ti	34	Adrain.	Colin	Mem	brane '	Traffic
--------------------------------	----	---------	-------	-----	---------	---------

- 36 Alves, Filipa | Biophysics and Genetics of Morphogenesis
- 38 Amorim, Maria João | Cell Biology of Viral Infection
- 40 Athanasiadis, Alekos | Protein-Nucleic Acids Interactions
- 42 Baena González, Elena | Plant Stress Signalling
- 44 Bank, Claudia | Evolutionary Dynamics
- 48 Becker, Jörg | Plant Genomics
- 50 Beldade, Patrícia | Variation: Development and Selection
- 52 Bettencourt Dias, Mónica | Cell Cycle Regulation
- 54 Carneiro, Jorge | Quantitative Organism Biology
- 56 Castro, Diogo S. | Molecular Neurobiology
- 58 Chaouiya, Claudine | Network Modelling
- 62 Chikhi, Lounès | Population and Conservation Genetics
- 64 Demengeot, Jocelyne | Lymphocyte Physiology
- 66 Domingos, Ana I. | Obesity
- 68 Duque, Paula | Plant Molecular Biology
- 70 Ferreira, Miguel Godinho | Telomeres and Genome Stability
- 72 Fesel, Constantin | Lupus and Autoreactive Immune Repertoires
- 76 Gjini, Erida | Mathematical Modelling of Biological Processes
- 78 Gonçalves-Sá, Joana | Science and Policy
- 80 Gordo, Isabel | Evolutionary Biology
- 82 Howard, Jonathan C. | Host-Pathogen Co-Evolution
- 84 Jansen, Lars E. T. | Epigenetic Mechanisms
- 86 Mallo, Moisés | Patterning and Morphogenesis
- 90 Martins, Vera | Lymphocyte Development and Leukemogenesis
- 92 Moita, Luís Ferreira | Innate Immunity and Inflammation
- 94 Oliveira, Raquel A. | Chromosome Dynamics
- 96 Oliveira, Rui F. | Integrative Behavioural Biology
- 98 Parkhouse, Michael | Infection and Immunity
- 100 Penha Gonçalves, Carlos | Disease Genetics
- 104 Perfeito, Lília | Evolution and Genome Structure
- 106 Rocha, Luís M. | Complex Adaptive Systems and Computational Biology
- 108 Soares, Miguel P. | Inflammation
- 110 Sucena, Élio | Evolution and Development
- 112 Teixeira, Luís | Host-Microorganism Interactions
- 114 Telley, Ivo A. | Physical Principles of Nuclear Division
- 116 Xavier, Karina B. | Bacterial Signalling
- 118 IN-HOUSE COLLABORATIONS 2018
- 120 EXTERNAL COLLABORATIONS 2018
- 122 EXTERNAL ASSOCIATED GROUPS 2018

CONTENTS



2 SUPPORT TO RESEARCH

	CORE FACILITIES
126	Animal House Facility
127	Transgenics Unit
128	Plant Facility
129	Bioinformatics and Computational
	Biology Unit
130	Genomics Unit
131	Histopathology Unit
132	Advanced Imaging Unit
133	Electron Microscopy Facility
134	Flow Cytometry Facility
135	Antibody Service
	SERVICES
137	Accounting and Internal Audit
137	Biosafety
138	General Maintenance
138	Informatics Unit Administrative Unit
139	Library
139	Procurement Unit
140	Project Management
140	Scientific Events Management & Welcome
141	Research Funding Affairs
142	Science Communication and Outreach
142	Directorate Assistants
143	Technico-Scientific Support
144	RESEARCH STRUCTURES & NETWORKS
	DURICATIONS

3 PUBLICATIONS

150	PEER-REVIEWED PUBLICATIONS
150	In-house publications
158	Epub ahead of print
158	IGC current address
158	Associated groups
159	PhD Programme
160	OTHER PUBLICATIONS
160	Proceedings
160	Book chapters
160	Other
	_
	<u> </u>

PRIZES & HONOURS



5 GRADUATE EDUCATION & TRAINING

168	PhD programme in Integrative Biology
	and Biomedicine IBB
172	PhD programme inBiology at the Host
	Microbe Interface INTERFACE
174	Graduate Programme Science for
	Development PGCD
175	Gulbenkian Training Programme in
	Bioinformatics GTPB
177	Postdoctoral Training
178	Summer Internship Programme
180	Theses 2018
182	Teaching at other PhD programmes



6 SEMINARS & MEETINGS

186	Seminars at the IGC 2018
196	Meetings, Conferences & Workshops 2018
203	Presentations by IGC researchers 2018
203	at international meetings and seminars
210	at national meetings and seminars



PUBLIC ENGAGEMENT 7 IN SCIENCE

218	Media Office
219	Multimedia Resources
219	Science Education Projects
219	Engagement of Socially Vulnerable
	Communities in Science
220	Public Events
221	Art & Science Projects
222	Other Participations
200	FUNDBAIGNIC

225 ACKNOWLEDGEMENTS

4



Mónica BETTENCOURT DIAS

Foreword from the DIRECTOR

was a year of celebration and change for IGC. It was the celebration of the 25th anniversary of the IGC PhD programmes started by António Coutinho and Alexandre Quintanilha. The Gulbenkian Doctoral Program in Biology and Medicine (PGDBM), initiated in 1993, introduced an innovative concept of postgraduate education both in Portugal and in Europe. A four-year doctoral program emerged that allowed students to first learn cutting-edge science before choosing the laboratory for their thesis work and writing their project. The format of the PGDBM motivated other doctoral programs in the country and abroad. At the IGC, a variety of PhD programmes followed, focusing on different topics, enrolling more than 600 students, the most recent one targeted to students from the Portuguese speaking African countries.

2018 was also a year to thank the departing IGC directors Jonathan Howard, José Mário Leite and Jorge Carneiro for their constant work, innovative initiatives, and dedication throughout their mandates, and to recognise the former management Committee and SAB for their outstanding work in overseeing IGC's strategy. Also, in the spirit of IGC's incubating mission, this year has seen a variety of different IGC groups, who started their

independent labs here, joining other great research communities, or creating companies. Such accomplishment further extends the IGC's alumni network and propagating IGC's mission and values beyond its walls. To all of them the IGC is forever grateful and wholeheartedly I wish them the best, hoping we keep connected and synergising through diverse activities and our Alumni Programme: Miguel Godinho Ferreira (IRCAN, Nice), Lars Jansen (Oxford University), Ana Domingos (Oxford University), Joana Gonçalves Sá (Nova Business school, PT), Claudine Chaouyia (I2M, Marseille), Florence Janody (I3S, Porto), Ivo Chelo (University of Lisbon) and José Pereira-Leal (Ophiomics, PT).

The values and modus operandi of the PhD programmes and of the IGC, imprinted initially by António Coutinho, are grounded in scientific excellence, proactivity and cooperation. These values had a strong influence on IGC scientists, bringing up many group leaders, science managers and directors of national and international research institutes and companies. Twenty-five years after the first programme, three former Gulbenkian PhD students, Élio Sucena, Isabel Gordo and myself, accepted the exciting challenge of becoming the scientific directors of IGC. Complementing each other in knowledge, we embraced the com-



"At IGC we aim at a deep understanding of living systems, how they are formed, how they function, as well as how they adapt to and shape their environments over different space and time scales. The future of biology, and of our health, lies on the understanding of genome, cell and organism's constraints in the light of ecological scales."

mon goal of fostering IGC's scientific excellence and lead IGC towards internationalization and closer to the society: three objectives that promote each other, which are also strongly part of the mission of the Gulbenkian Foundation. Together with a new managing director, Manuel Schmidt, we are bound to a strong legacy and to a strong foundation, and will uphold its principles whilst thriving to place the Institute and its programmes ahead of the wave through constant innovation: "Gulbenkian science: solving tomorrow's challenges".

It is a special time to do this. The international standing of the IGC achieved by its former and current directors, scientists and staff, the immense network of people associated to the institute, the initiatives within the Gulbenkian Foundation to promote communication and activities across programmes, all together, make our task more exciting and feasible. Indeed, we believe that with

the continued generous support of the Gulbenkian Foundation, conditions exist to consolidate IGC's place as a world leading research institution where individuals pursue the most original discovery driven scientific questions. We believe this can be achieved via constant attention of a committed board of directors to support its researchers facing present and future challenges and the principles of cooperation that senior members transmit to new generations. We also want IGC to be an Institute, where innovation is not just in the science but also on how science is done and impacts society. Perhaps now, more than ever, it is imperative that society and science meet such that the importance of evidence-based knowledge to make decisions becomes part of our description as humans.

We want to have a strong impact in Portugal, but also in the rest of the world, through our discoveries and our initiatives. Portugal is historically and geographically a great country to pioneer initiatives bridging North and South and due to its size, to quickly evaluate their impact. To do this, we are reaching out to other excellent places and seeking technological, scientific and societal synergism so that each is much more than the sum of its parts. The future mark of Portugal in Science depends on this synergy.

At IGC we aim at a deep understanding of living systems, how they are formed, how they function, as well as how they adapt to and shape their environments over different space and time scales. The future of biology, and of our health, lies on the understanding of genome, cell and organism's constraints in the light of ecological scales. The IGC has focused on organism-centered research in the past and will continue to excel on this front. It's time to extend IGC's ambition by seeking to further explain the interactions between organisms and their environment. This is possible now, due to technological developments, but only feasible in a scientifically diverse research Institute, with people that think at different scales and study various systems, where communication is fostered to integrate perspectives. The paper accepted in 2018, by a shared PhD student between the Jansen and Perfeito labs, on how heritable gene silencing can accelerate the rate of adaptation (Nature Ecology & Evolution, in press) is a great example of how different expertise can bridge scales to produce new concepts in biology, something that we have seen reoccurring at IGC. We hope more of this will come through, as activities and the environment foster discipline crossing.

Already, in 2018, many of our scientists and support staff started to participate and organise activities that will foster their personal development and science. In consequence, 2019 will have an exciting start, with several important events along our mission:

- The first IGC Institute wide retreat, whose organising committee was chaired by Vera Martins, aimed to promote dissemination of the science we do within the Institute, sharing of our values, and approximation to our Alumni and to other activities at the Gulbenkian Foundation;
- The presence of several scientists in sabbatical at IGC, to provide critical mass and new ideas;
- The visit of our new SAB, chaired by Herbert Jaeckle and composed by great scientists, who will guide us in our strategy, helping us to set ambitious, yet feasible goals;
- The visit of an international committee to review



"We also want IGC to be an Institute, where innovation is not just in the science but also on how science is done and impacts society. Perhaps now, more than ever, it is imperative that society and science meet such that the importance of evidence-based knowledge to make decisions becomes part of our description as humans."

and help to improve our facilities, chaired by Ivan Baines:

- An effort regarding human resources started by developing a training unit chaired by Ana Aranda, a code of conduct, an ombudsperson office, continuing into a career plan that will help people to excel and personally develop at the IGC;
- The international application and implementation of the necessary structures towards IGC to receive the international seal of research excellence.

The IGC new strategy focuses on three pillars which are interdependent: excellent science, collaboration and internationalization, and to impact and connect with society ("science from all to all"). In 2018, we began a variety of initiatives that will start to bear fruit in 2019, strengthening our science: a recruitment call, a new multidisciplinary postdoctoral program, the strengthening of our funding office with new personnel, changes in admin to further support scientists and facilities. On the collaboration and internationalization front, our aim is to bring Gulbenkian to the

centre of global science and to increase the critical mass and access to our infrastructures. IGC is already working on extending its scientific, infrastructure and training partnerships with national and international research and clinical institutions. Moreover, Joana Gonçalves Sá and Patrícia Beldade are strengthening the Gulbenkian Science for Development Program in partnership with the MERCK family Foundation. Finally, to foster collaboration and internationalization we are creating an International, Multidisciplinary Collaborative Centre. First of its kind in Europe. this centre will mix fundamental research with proof-of-concept work. The IGC is refurbishing existing infrastructure to attract world leading scientists and companies to interact with each other and with local and national groups, host sabbaticals, courses, workshops, small conferences, summer schools, and develop postgraduate education. An expected collateral outcome of this initiative is to facilitate recruitment of world-class researchers and attract companies to Portugal, as well as capacitating researchers from developing countries. Finally, in partnership with the city council and local science institutions we are extending our science in society programme. We are creating a local joint knowledge and technology transfer office (TTO) to promote the application of specific findings and to foster links with industry. Moreover, we are developing an extensive program to foster citizen science and being inclusive, taking science and advocating fundamental research and our values to hospitals, schools, parliament and media.

2019 promises to be a very exciting year. We look forward to all these developments, to your commitment and proactivity at IGC.

Thank you to all of you for making the IGC the special place to be!





Organisation

Founded in 1961, the Instituto Gulbenkian de Ciência (IGC) is part of the Calouste Gulbenkian Foundation (FCG), a private charitable foundation promoting innovation in charity, arts, education and science. Our Mission, Vision and Values are fully aligned with Calouste Gulbenkian Foundation principles. The direct governance of the Institute is made through the Director, a Deputy Director with primary responsibility for financial administration, and two Deputy Directors for Science. The Director is in turn answerable to the FCG Board of Trustees. An eminent external Scientific Advisory Board oversees the scientific activity of the IGC, whereas the Ethics Committee assures the ethical conduct of the scientific activities related to vertebrate animals or human beings. The Scientific Advisory Board and the Ethics Committee are appointed by FCG Board of Trustees.

FCG Board of Trustees

Isabel Mota | President

Teresa Gouveia Martin Essayan José Neves Adelino Guilherme d'Oliveira Martins Emílio Rui Vilar* Graça Andresen Guimarães* António M. Feijó* Pedro Norton*

Instituto Gulbenkian de Ciência

Jonathan Howard | Director (up to January 2018) Mónica Bettencourt-Dias | Director (from February 2018)

José Mário Leite | Deputy Director (up to May 2018) Manuel Schmidt | Deputy Director (from April 2018)

Jorge Carneiro | Deputy Director for Science (up to March 2018) Isabel Gordo | Deputy Director for Science (from February 2018) Élio Sucena | Deputy Director for Science (from February 2018)

^{*} Non-executive trustees



Scientific Advisory Board

Kai Simons | Chairman

Max Planck Institute for Molecular Cell Biology and Genetics, Dresden, Germany

Martin Raff

Utniversity College London, UK

David Sabatini

New York University, USA

Terrence Sejnowski

The Salk Institute, USA

Tony Hyman

Max Planck Institute, Dresden, Germany

Linda Partridge

Max Planck Institute, Cologne, Germany

Ruslan Medzhitov

Yale University, New Haven, USA

Paul Schmid-Hempel

ETH Zurich, Switzerland

Ginés Morata

Centro de Biología Molecular Severo Ochoa, Spain

Ethics Committee

Tânia Carvalho PhD, DVM | Chairperson

Instituto de Medicina Molecular, Portugal

Carlos Penha-Gonçalves PhD, DVM

IG(

Manuel Rebelo PhD

IGC

Miguel Fontes MD

External member

Isabel Garcia Civil Servant

External member

Vera Martins PhD

IGC

Maria de Athayde Tavares Lawyer

External member

Vasco Trigo Journalist

External member

Ana Cristina Borges PhD

IGC

The IGC at a glance

The Instituto Gulbenkian de Ciência (IGC) is a private institute devoted to basic biological and biomedical research, innovative training and to transforming society through science. The IGC is free from hierarchical structure, with small independent research groups working in an environment designed to foster interaction and cooperation.

The IGC mission is to meet science global challenges, making ground-breaking discoveries in Life Sciences, innovating in training, incubating the next generation of future leaders and placing science at the heart of society.

IGC research programmes cover a wide range of domains and are at the interface of different disciplines, studying a large range of organisms, from bacteria, to plants, to humans. These include cell and developmental biology, evolutionary biology, physiology and host-microbe interactions, sociobiology, computational biology and biophysics.

Integrated in national and international research structures and networks, the IGC is part of the Oeiras Campus, home to several other basic and applied research centres in biology, biotechnology and chemistry.

- Since 1998, the IGC has hosted 88 research groups; 51 of these have moved on to other research institutes, 32 to research centres in Portugal.
- In 2018, the IGC PhD programmes celebrated 25 years. Since 1993, 10 PhD Programmes have been set up, with approximately 80 speakers/year/programme.
- » By December 2018, around 600 PhD students had started their science education at the IGC in programmes and research groups.





41 **Nationalities**

267 Portuguese 113 Rest of the World

- Albania
- Argentina
- Bangladesh 1
- Belgium 1
- 5 Brazil
- 1 Canada
- Cape Verde Islands
- Colombia

- Croatia
- Ecuador
- Estonia 1
- France 9
- 9 Germany
- 3 Greece
- 1 Hungary India
- Iran
- 2 Ireland
- 8 Italy
- 2 Japan
- 1 Lebanon
- 2 Mexico
- Morocco 1 Nepal
- Netherlands
- Nigeria
- Poland
- 267 Portugal Romania
- 1 Russia
- Serbia 1
- Slovenia

- 17 Spain
- Sweden
- Switzerland
 - Syria
- Tanzania
- Ukraine United Kingdom
- United States
- Venezuela

FACTS & FIGURES

283 Researchers

Of which 139 are PhD holders

(not including visitors)

As of 31st December 2018



380

People work at the IGC

Including 22 visitors 219 F | 161 M

77 Postdocs 89 PhD students 39 Research Groups' technicians 18 Masters students 10 Trainees 22 Visitors 3 PhD programmes

4 Departing Research Groups



35 Group Leaders

19 Portuguese 16 Rest of the World 15 F | 20 M



10 Core Facilities

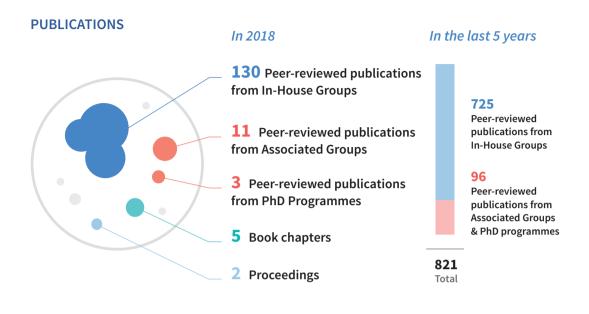
56 Core facility staff, of which 14 are PhD holders (3 Heads are also Group Leaders)



11 Services

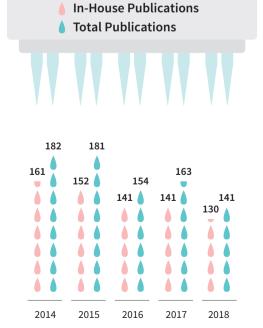
42 Service unit staff, of which 9 are PhD holders

SCIENTIFIC COMMUNICATION



PUBLISHED ITEMS with IGC address in each year

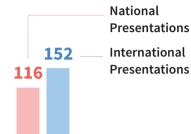
Source: Web of Science, January 2018



PRESENTATIONS BY IGC RESEARCHERS

THESES



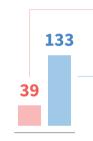






SEMINARS & MEETINGS





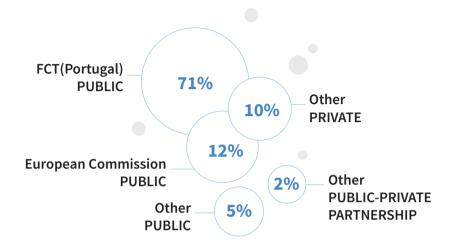
Conferences, Meetings & Workshops organised by IGC researchers

Seminars at IGC 90 from External speakers



AWARDS & GRANTS secured by IGC researchers

RESEARCH GRANTS BREAKDOW by funding source 2014-2018





- 1 EMBO workshop
- 1 EMBO practical course
- 1 Godfrey Hewitt Mobility Award
- 1 Society for Mathematical Biology Conference Organizer Award
- 1 Tebu-Bio's Researchers Travel Grant
- 1 Society for the Study of Evolution (SSE) Travel Stipend

OTHER RESEARCH GRANTS AWARDED IN 2018

- 1 ERC Starting Grant
- 1 EMBO Installation Grant
- 1 Iberian Initiative of Biomedical Research and Innovation from La Caixa Banking Foundation and ECT
- 1 Biochemical Society Scientific Outreach Grant
- 1 FCT
- 1 Instituto Português de Oncologia de Lisboa, Francisco Gentil



PRIZES & HONOURS, including:

- 1 New Institutional Funding
- 1 FCT Concurso Estímulo ao Emprego Científico
- Institutional (Principal Investigator level)



129 GRANTS in the last 5 years

Source: IGC Research Funding Affairs

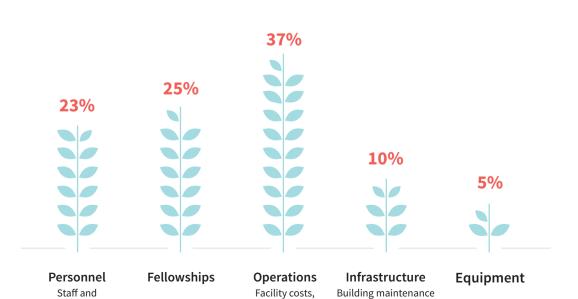
Budget Overview 2018



Researchers



BREAKDOWN OF IGC EXPENDITURE



others

and refurbishments

A walk through 2018



Farewell to Director Jonathan Howard During the New Year's lunch, the IGC community gathered to thank Jonathan Howard for the past 5 years as Director of the IGC.



AMeeGuS - IGC PhD students retreat The 12th Annual Meeting of Gulbenkian Students (AMeeGuS), organised by and for doctoral students of IGC, encouraged PhD students to discuss their own projects via seminar or poster, and to participate in other activities.

JAN

MAR

FFR



New IGC Director assumed office Mónica Bettencourt-Dias assumed administrative duties at the IGC succeeding to Jonathan Howard as Director of the IGC.



Inaugural meeting of the International Research Scholar Programme

The Calouste Gulbenkian Foundation hosted the Inaugural Meeting of the HHMI International Research Scholar programme. This event was organized by the IGC and brought together the 36 outstanding scientists selected in 2017 for this programme.

Workshop "Inspirar Ciência – Plantas"

Twenty Biology high school teachers learnt the most recent advances in plant biology fields in theoretical and laboratory sessions taught by IGC scientists.



International Day of Immunology

The IGC joined the Portuguese Society for Immunology (SPI) in the celebrations of the International Day of Immunology, with a programme of talks for lay public.





Workshop on Telomere Biology in Health and Human Disease

This EMBO Workshop, organised by IGC group leader Miguel Godinho Ferreira, focused on the molecular mechanisms of telomere biology and how this is compromised in human genetic disorders, ageing and cancer.

MAY

APR

JUNE

EMBO workshop on Plant Evolution at FCG

About 170 researchers gathered at the Calouste Gulbenkian Foundation (FCG) to share and learn the latest discoveries in the field of land plant evolution. The EMBO workshop 'New shores in land plant evolution' was co-organized by Jörg Becker, group leader at IGC.



Call for Group Leaders

The IGC opened a public call to recruit outstanding independent Fellows or Principal Investigators. Two hundred and twenty researchers from all over the world applied to these positions, 16 of which were shortlisted to the IGC's recruitment symposia that took place in September.





EMBO Practical Course: 3D Developmental Imaging

The IGC hosted the 10th anniversary edition of the EMBO practical course on 3D Developmental Imaging. During this 9-day course, more than 20 experts in 3D optical microscopy will work with 16 students. This event was organized by Gabriel Martins, Head of the Advanced Imaging Facility at IGC.



Science at NOS Alive Music Festival

The IGC was present at NOS Alive festival for the 11th time in a row. In this edition, the scientists brought to the festival "The Dark Side of Science" installation.



Workshop on Biophysical Constraints and Evolutionary Cell Biology

Thirty scientists gathered at the IGC to discuss the macro and micro-environmental constraints that have shaped the evolution of cells. This event was co-organised by Mónica Bettencourt-Dias.

JULY

IGC researcher received 1,37 million from European Research Council

Claudia Bank, group leader at IGC, was awarded with an ERC Starting Grant to develop her research programmes on how populations adapt and diversify in new environments.





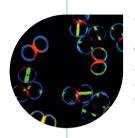
Colin Adrain awarded by the Iberian Initiative of Biomedical Research and Innovation

The IGC group leader was one of the eight researchers in Portugal awarded in the first edition of the Iberian Initiative of Biomedical Research and Innovation' promoted by la Caixa Banking Foundation (Spain) and Fundação para a Ciência e a Tecnologia (Portugal). The consortium led by Adrain received more than 960 000€.

IGC Summer School

Sixteen undergraduate students were selected to work at 13 different laboratories during the IGC summer school.





Call for the 2018 Biology at the Host Microbe Interface (INTERFACE) PhD Programme

Applications to the PhD programme Biology at the Host Microbe Interface (INTERFACE) were opened. This PhD programme results from a joint initiative of three research institutions: IGC, Instituto de Tecnologia Química e Biológica António Xavier and IMM- Instituto de Medicina Molecular João Lobo Antunes.

SEPT

AUG



25 Years of IGC's PhD Programmes

The celebrations of the 25th anniversary of the IGC PhD programmes took place at the Calouste Gulbenkian Foundation, Champalimaud Foundation and IGC with talks from many IGC alumni. In 25 years, almost 600 doctorates helped changing the way we do science in Portugal and worldwide

IGC's recruitment symposia

In this event, the 16 shortlisted candidates to IGC positions as Fellows and Principal Investigators positions were invited to give a lecture and discuss their science and future plans with the IGC scientific community.





European Researchers Night 2018

Researchers from IGC took an activity on infectious diseases to the outreach event that took place at the Museum of Natural History and Science in Lisbon.







IGC Open Day
More than 1500 citizens interacted with IGC scientists and engaged in science activities during the 9th edition of the IGC Open Day.





IGC Symposium 2018: Microbial Eco-Evolutionary Dynamics
This symposium, organised by IGC Postdoctoral fellows and PhD candidates, hosted about 100 scientists to discuss how the interplay of ecology, evolution and environmental/temporal variation can shape microbial variation.

ОСТ

Africa Science Week Cabo Verde 2018 Cabo Verde received, for the first time, the Next Einstein Forum – Africa Science Week. This event was organised by Sara Batista and Yara Rodrigues, PhD students from the IGC Graduate Programme Science for Development.



Maria João Amorim participated in the International Visitor Leadership Program USA – Women in STEAM Fields

This program, organized by the US government, invited 49 women from different countries to debate the challenges and opportunities of women in STE(A)M fields. The IGC group leader was the sole scientist from Portugal in this event.

Conference: How to improve current Science Funding?

The first of a series of conferences to discuss the Portuguese scientific system was organized by Mónica Bettencourt Dias and Joana Gonçalves Sá, group leaders at the IGC, and took place at the Fundação Calouste Gulbenkian.





Open Science: new handbook in Portuguese

The first Portuguese version of the Open Science Training Handbook - "Manual de Formação em Ciência Aberta" was made available online. It was developed in collaboration with Pedro L. Fernandes, coordinator of the Gulbenkian Training Programme in Bioinformatics.



IGC hosted the 2nd FLxFlow Course

This course covered the fundamentals of flow Cytometry technology through a series of lectures, exercises, practical examples and interactive learning. It was co-organized by Marta Monteiro, Head of the Flow Cytometry unit at IGC.

NOV



IGC Open Day - Universities

This event was aimed at undergraduate students (BSc and MSc) interested in knowing more about IGC scientific research, training and science careers.



IGC scientists at the biggest book fair of Latin America

Paula Duque and Élio Sucena, group leaders at IGC, participated in "Feria Internacional del Libro de Guadalajara" (FIL), representing Portuguese Science at this important cultural event.





New Artist in Residence at IGC

ALAgrApHY, artistic name of Alaa Abi-Haidar, began an artistic residence at the IGC to work on visualization of data generated by IGC scientists, using artificial intelligence.

DEC



Claudia Bank awarded with EMBO Installation Grant

The funding from the European Molecular Biology Organization will help the IGC group leader to further establish the Evolutionary Dynamics Research Group at the IGC.

1st Open Call for Biology By Numbers Postdoctoral programme

This new multidisciplinary programme is aimed at PhD holders from Exact Sciences & Engineering interested in pursuing fundamental biological questions.





Some Science Stories from 2018

New light on the mysterious origin of Bornean elephants

How did Borneo get its elephants? This could be just another of Rudyard Kipling's just so stories. The Bornean elephant is a subspecies of Asian Elephants that only exist in a small region of Borneo. Their presence on this southeastern Asian island has been a mystery. In a study published in Scientific Reports, a research team led by Lounès Chikhi from IGC and CNRS (France), and by Benoit Goossens, from Cardiff University (Wales) and Sabah Wildlife Department (Malaysia), found that elephants might have arrived on Borneo at a time of the last land bridge between the Sunda Islands in Southeast Asia.

Until recently, two opposing theories have been under debate to explain the origin of Bornean elephants: they could have been recently introduced by humans, maybe 300 years ago, or they could have diverged from Asian elephants a long time ago. To shed light on the Bornean elephant's or-

igin, Chikhi and Goossens' team created computational models for different scenarios that might have happened. Then, they compared the results from these models with the existing genetic data, and used statistical techniques to identify the scenario that best explained the current genetic diversity of the elephant population in Borneo. Their results suggest that the most likely scenario to have occurred is a natural colonization of Borneo around 11,400 to 18,300 years ago. This period corresponds to a time when the sea levels were very low and elephants could migrate between the Sunda Islands, a Southeastern Asia archipelago to which Borneo belongs.

Sharma, R., Goossens, B., Heller, R., Rasteiro, R., Othman, N., Bruford, M. W., & Chikhi, L. (2018) *Genetic analyses favour and ancient and natural origin of elephants on Borneo.*Scientific Reports, 8(1). DOI: 10.1038/s41598-017-17042-5

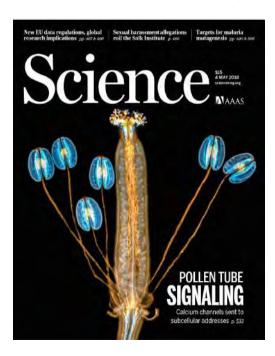


The Bornean elephant is the smallest of all elephants. Credits: Rudi Delvaux (http://www.rudidelvaux.com/borneoenglish.html)

A New Model for Communication in Plant Cells

For many years biologists have wondered why plants have so many proteins similar to those known to be essential for the nervous system of animals, called the glutamate receptors. In animals, part of these receptors' functions consists in allowing calcium to enter inside neurons so that the nerve signal is communicated. While plants lack a true nervous system, previous studies have shown that plants need these glutamate receptor-like proteins (GLRs) to do important things such as mate, grow, and defend themselves against diseases and pests.

Working with *Arabidopsis thaliana* pollen cells, a research team led by José Feijó, a former researcher at IGC, found that GLRs form the basis of a communication network inside individual plant



cells. They observed that GLRs are redistributed to other compartments inside plant cells, forming a complex network that cooperates to regulate calcium concentrations and enable calcium signalling. This suggests a model for plant cell communication that is unlike anything found in animals. While animal neurons use glutamate receptors to conduct signals from cell to cell, Feijó's team suggested that plants depend on communication strategies that operate at the single-cell level.

This research, published in the *Science* journal, was initiated by José Feijó's team at Instituto Gulbenkian de Ciência, and was continued and completed at the University of Maryland (USA) after the research group moved to this institute.

Wudick, M. M., Portes, M. T., Michard, E., Rosas-Santiago, P., Lizzio, M. A., Nunes, C. O., Campos, C., Damineli, D. S. C., Carvalho, J. C., Lima, P. T., Pantoja, O., & Feijó, J. A. (2018) *CORNICHON sorting and regulation of GLR channels underlies pollen tube Ca*²⁺ homeostasis. **Science 360**(6388): 533-536. https://doi.org/10.1126/science.aar6464

This research featured Science's cover of 4 May 2018. Image caption from Science journal: Fluorescence microscopy composite image of an *Arabidopsis* flower with six male organs (anthers) bearing pollen grains (blue dots inside) and the central female organ (ovary) bearing two lines of ovules (light blue) targeted by pollen tubes (orange lines). Credits: Pedro Lima and José Feijó.

Finding the Achilles heel of cancer

Cancer is a diverse disease with some tumours being more aggressive and more resistant to chemotherapy than others. Clinicians are eager to find novel diagnostic, prognostic and treatment tools that allow them to predict outcomes and treat patients in a more personalised way.

In a study published in Nature Communications, a research team led by Mónica Bettencourt Dias observed that the number and size of tiny structures that exist inside cells, called centrosomes, are increased in the most aggressive subtypes of cancer. The researchers thoroughly analysed a panel of 60 human cancer lines originated from 9 distinct tissues. Their results revealed that cancer cells often have extra and longer centrosomes. which are absent in normal cells. Importantly, the research team observed that supernumerary centrosomes are more prevalent in aggressive breast - as the triple negative - and colon cancer. Also, the team discovered that longer centrosomes are excessively active, which perturbs cell division and could favour cancer formation.

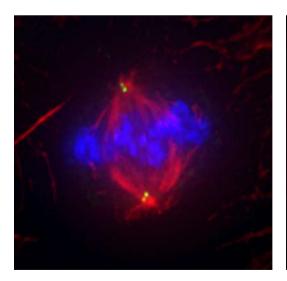
In another study Bettencourt Dias' group examined samples from patients with Barrett's esophagus, a condition that increases the risk of development of esophageal cancer. They discovered

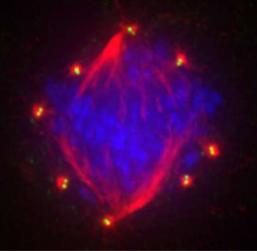
that changes in centrosomes are also present in pre-malignant lesions of esophageal cancer, and can be associated with the onset of this type of cancer. This study, published in the *Journal of Cell Biology*, was conducted in collaboration with Paula Chaves' team at Instituto Português de Oncologia Francisco Gentil (IPO Lisbon).

Both studies suggest that centrosomes might be used as a tool for diagnosis, prognosis and treatment of cancer.

Marteil, G., Guerrero, A., Vieira, A. F., de Almeida, B. P., Machado, P., Mendonça, S., Mesquita, M., Villarreal, B., Fonseca, I., Francia, M.E., Dores, K., Martins, N.P., Jana, S. C., Tranfield, E. M., Barbosa-Morais, N. L., Paredes, J., Pellman, D., Godinho, S. A., & Bettencourt- Dias, M. (2018) Over-elongation of centrioles in cancer promotes centriole amplification and chromosome missegregation. Nature Communications, 9 (1). https://doi.org/10.1038/s41467-018-03641-x

Lopes, C. A. M., Mesquita, M., Cunha, A. I., Cardoso, J., Carapeta, S., Laranjeira, C., Pinto, A. E., Pereira-Leal, J. B., Dias-Pereira, A., Bettencourt-Dias, M., & Chaves, P. (2018) Centrosome amplification arises before neoplasia and increases upon p53 loss in tumorigenesis. Journal of Cell Biology 217(7), 2353–2363. https://doi.org/10.1083/jcb.201711191





Healthy cells (left image) display 4 centrioles, a normal number (in yellow). On the contrary, breast cancer cells (triple negative) have extra centrioles (here 16, right image). Credits: Gaëlle Marteil, IGC.

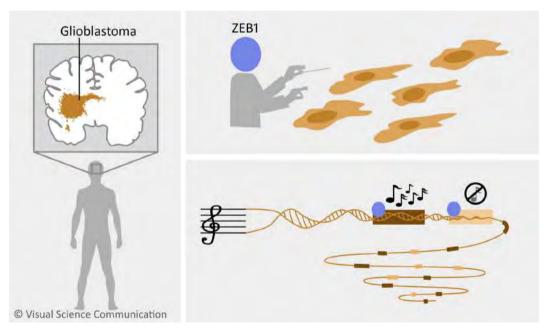
A maestro that conducts the invasiveness of glioblastoma tumors

Glioblastoma is the most severe form of brain cancer in adults. The aggressiveness of this cancer is largely due to its ability to invade surrounding brain tissue, making the tumor difficult to remove by surgery. This is in part because its cancer cells easily blend in with normal cells. But also because glioblastoma contains "cancer stem cells", which have the capacity to originate a new tumor. If a few of these cells are left behind, a new tumor begins to form.

In order to understand the mechanisms that allow glioblastoma cells to invade the surrounding brain tissue, a research team led by Diogo Castro, from IGC, pinpointed the role of Zeb1 in this process. Zeb1 is a transcription factor, acting inside the cell as a conductor does with an orchestra; it informs which genes should become active and when. Using cultures of cells established from human biop-

sies and genetic databases constructed from the analysis of hundreds of gliobastoma tumors, the researchers mapped which genes within the genome are targeted by Zeb1. Strikingly, researchers observed that Zeb1 orchestrates changes in the properties of cancer cells, by playing a dual role: it is able to simultaneously switch "on" and "off" a vast number of genes. This changes how cancer cells interact with each other, and makes them motile so they can migrate away from the tumor mass. This research was published in *The EMBO Journal*.

Rosmaninho, P., Mükusch, S., Piscopo, V., Teixeira, V., Raposo, A. A., Warta, R., Bennewitz, R., Tang, Y., Herold-Mende, C., Stifani, S., Momma, S., & Castro, D. S. (2018) *Zeb1 potentiates genome-wide gene transcription with Lef1 to promote glioblastoma cell invasion.* **The EMBO Journal**, 37(15), e97115. https://doi.org/10.15252/embj.201797115



Zeb1 is able to simultaneously switch "on" and "off" a large number of genes in cancer cells, acting as a "conductor" that coordinates a genetic program that drives cell invasiveness of glioblastoma tumors. Credit: Visual Science Communication.

Cheating on cheaters: exploring bacterial social interactions to manipulate bacterial pathogens

Similar to human societies, bacteria live in communities and interact with each other in order to better adapt to the environment. Regularly, they produce compounds that behave as public goods, as they are secreted to the surroundings and are consumed by the entire population, benefiting the whole bacterial community. However, some bacteria carry mutations that prevent them from producing those public goods. These bacterial mutants act as cheaters, benefiting from the public goods without contributing to their production. In the presence of a cheater the bacterial population can collapse. But in nature, in an infected organ-

ism, the bacterial population may include various mutants that are deficient in the production of a different compound. So, what happens if other cheaters are playing the same game?

To investigate these social interactions, Karina Xavier's team at IGC used *Pseudomonas aeruginosa*, an opportunistic pathogenic bacteria that infects lungs. The researchers observed that interactions between two bacterial mutants and normal bacteria could prevent the population collapse. However, when they changed the nutrients given to the bacteria they could lead a stable population to extinction. This study, published in

Current Biology, shows novel ways to promote socalled "cheating behavior" in bacterial communities that can lead to the collapse of the bacterial population, simply by manipulating the chemical composition of the environment. Strategies that include blocking bacterial social behaviors, possibly in combination with traditional antibiotics, might become efficient tools to overcome the problem of antibiotic resistance.

Özkaya, Ö., Balbontín, R., Gordo, I., & Xavier, K. B. (2018). Cheating on Cheaters Stabilizes Cooperation in Pseudomonas aeruginosa. Current Biology, 28(13), 2070–2080.e6. https://doi.org/10.1016/j.cub.2018.04.093



Petri dishes with bacteria. Credits: Roberto Keller

How our cells build different antennae to sense the world around us

Our body is made up of millions of cells that communicate with each other and with the environment using tiny antennae, called cilia that emit and receive signals, including sound, smell and light. Some cilia can also move, and are altered in several diseases leading to infertility, loss of vision, obesity, among other symptoms. Interestingly, some patients may show all of these symptoms, while others may have only one type of defect. Having such different functions, a lingering mystery in science has been how cells can make antennae with such different functions. Do they use the same "bricks", "cement", "wood" in their construction? In a study published in Nature Cell Biology, a research team coordinated by Monica Bettencourt Dias discovered that the foundation of these cilia is diverse, contributing to its assembly with such different functions. The researchers found that while cells use many of the same building components, they are present in different proportions and in different moments in space and time, in different tissues. These results can explain why patients with mutations associated with cilia will only show some of the symptoms, contributing to the understanding of ciliopathies.

Jana, S. C., Mendonça, S., Machado, P., Werner, S., Rocha, J., Pereira, A., Maiato, H., & Bettencourt-Dias, M. (2018). Differential regulation of transition zone and centriole proteins contributes to ciliary base diversity. Nature Cell Biology, 20(8), 928–941. https://doi.org/10.1038/s41556-018-0132-1

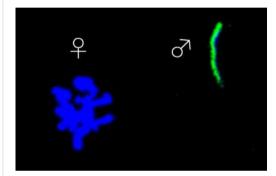
A protein that promotes the compatibility between maternal and paternal chromosomes after fertilization

Mother and father pass on their genetic information in a different manner. While the maternal chromosomes in the egg are still undergoing division, the paternal chromosomes carried by the sperm have both completed their division and been substantially compacted to fit into the small volume of the sperm cell. The mechanisms through which the fertilized egg levels these differences between parental chromosomes - an essential aspect for the correct initiation of embryo development – have been largely unknown.

A research team led by Rui Gonçalo Martinho, from the Center for Biomedical Research at the University of Algarve (UAlg), and by Paulo Navarro-Costa, from IGC and UAlg, uncovered a protein called dMLL3/4 that allows the fertilized egg to ensure both the correct division of the maternal chromosomes and the unpacking of the paternal genetic information. Using the fruit fly *Drosophila melanogaster*, the researchers observed that during egg development dMLL3/4 promotes the expression of a set of genes that will later be essential for balancing out differences between the chromosomes inherited from the mother and from the father.

This study, published in the scientific journal *EMBO Reports*, opens the door to new diagnostic approaches to female infertility, and to possible improvements in embryo culture media formulations for assisted reproduction techniques.

Prudêncio, P., Guilgur, L. G., Sobral, J., Becker, J. D., Martinho, R. G., & Navarro-Costa, P. (2018). *The Trithorax group protein dMLL3/4 instructs the assembly of the zygotic genome at fertilization*. **EMBO Reports**, **19**(8), e45728. https://doi.org/10.15252/embr.201845728



Maternal (\cite{S}) and paternal (\cite{S}) chromosomes in a recently fertilized fruit fly egg. DNA is in blue; the paternal chromosomes are also labelled in green. Credits: Paulo Navarro-Costa, IGC.

A tap that controls the flow of pro-inflammatory molecules

One of the major therapeutic targets for inflammatory diseases is the inflammation-inducing molecule TNF. This molecule is released from the surface of immune cells, called macrophages in response to infection and helps to coordinate the actions of the immune system to fight the pathogen. Although beneficial in clearing infection, excess or prolonged TNF release can be harmful. Elevated levels of TNF are associated with septic shock, can drive the development of some cancers, and are strongly associated with chronic inflammatory diseases (e.g. rheumatoid arthritis, Crohn's disease, ulcerative colitis, psoriasis, ankylosing spondylitis).

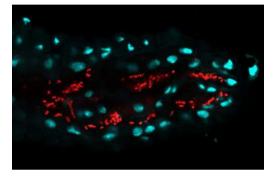
In a study published in the *eLIFE Journal*, Colin Adrain's team at IGC discovered a new protein, called iTAP that controls the levels of TNF in circulation by regulating its release from immune

cells. TNF molecules are normally attached to the cell surface, but to perform many of their functions, they have to be released from the membrane by an enzyme called TACE. iTAP's role is to prolong the amount of time TACE spends on the cell surface to promote TNF release. The researchers found that when the iTAP gene is removed from human or mouse cells, the release of TNF is reduced substantially because TACE is destabilized and degraded.

Oikonomidi, I., Burbridge, E., Cavadas, M., Sullivan, G., Collis, B., Naegele, H., Clancy, D., Brezinova, J., Hu, T., Bileck, A., Gerner, C., Bolado, A., von Kriegsheim, A. Martin, S. M., Steinberg, F., Strisovsky, K., & Adrain, C. (2018). *iTAP, a novel iRhom interactor, controls TNF secretion by policing the stability of iRhom/TACE.* ELife, 7. https://doi.org/10.7554/eLife.35032

Fruit flies farm their own probiotics

The role of bacteria inhabiting our bodies is increasingly recognized as part of our wellbeing. It is in our intestines that the most diverse and significant bacteria community is located. It is believed that the manipulation of this community – named microbiota – can contribute to solve some diseases. However, to enable it, it is necessary to understand which are the bacteria and how they colonize the intestine.



Microscopic image of beneficial bacteria associated with fruit flies anterior gut. The nuclei of fly's cells are stained in blue and bacteria are stained in red. Credits: Inês Pais and Rita Valente.

A study led by Luís Teixeira and published in the PLoS Biology offers a new tool to study this bacteria-host interaction. The IGC team revealed how the bacterial community colonizes the fruit flies kept in the lab or in the wild, and which may be the impact of this colonization in nature. The researchers showed that fruit flies have a bacterial community much more stable than it was believed. However, there are differences between flies kept in the laboratory and from the wild. Laboratory flies are associated with bacteria that are not able to colonize the intestine. Instead, these bacteria grow in the flies' food and are constantly ingested by them. On the contrary, bacteria associated to wild flies have a much higher colonization capability. Furthermore, wild flies practice a kind of farming by transporting with them the bacteria that are sown in the local where the next generation will grow and feed. Doing so, the next generation of flies will obtain all the benefits related to these bacteria for their development and fertility.

Pais, I. S., Valente, R. S., Sporniak, M., & Teixeira, L. (2018). Drosophila melanogaster establishes a species-specific mutualistic interaction with stable gut-colonizing bacteria. PLOS Biology, 16(7), e2005710. https://doi.org/10.1371/journal.pbio.2005710

"Traffic wardens" of cells can be counterproductive

In order to divide into two equal cells, a mother cell must replicate its DNA and divide it equally. Correct division is important to assure that new cells receive the exact number of chromosomes. When failures occur during this process, the associated errors can contribute to the development of several diseases. To avoid these failures, the cell has a regulation mechanism called the Spindle Assembly Checkpoint, or Mitotic Checkpoint. It was generally established that the mitotic checkpoint is important to prevent errors in chromosomal distribution during cell division, as it halts the completion of mitosis if errors are present. However, a study from the IGC and the Centre for Biomedical Research (CBMR) at University of Algarve (UAlg) stirred up the scientific dogma that the mitotic checkpoint is always beneficial for the dividing cell.

Using as research model the fruit fly *Drosophila melanogaster*, the research team lead by Raquel Oliveira (IGC) and Rui Gonçalo Martinho (CBMR/UAlg), found that the action of these cell "traffic wardens" can be counterproductive when cells presented problems in the "glue" that joins chromosomes. When facing these irreversible errors, the continuous action of the mitotic checkpoint can lead to an increase of errors in chromosomes distribution. This study was published in the *Current Biology* journal.

Silva, R. D., Mirkovic, M., Guilgur, L. G., Rathore, O. S., Martinho, R. G., & Oliveira, R. A. (2018). Absence of the Spindle Assembly Checkpoint Restores Mitotic Fidelity upon Loss of Sister Chromatid Cohesion. Current Biology, 28(17), 2837–2844.e3. https://doi.org/10.1016/j. cub.2018.06.062

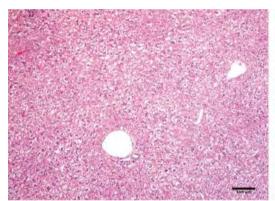
A promising biomarker for hepatic disease

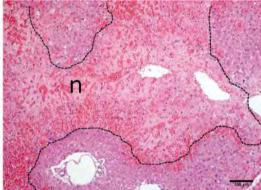
Hepatic diseases are silent diseases. Diagnosing their severity is a hard task and mainly depends on liver biopsies, a highly invasive procedure. The identification of molecules that could be used as biomarkers of liver wounds would allow a more accurate non-invasive diagnosis. In a study published in the *Hepatology Communications* journal, a research team led by Carlos Penha-Gonçalves from IGC and Maria Paula Macedo, from CE-DOC-NOVA Medical School | Faculdade de Ciências Médicas, showed that a molecule designated by CD26/DPP-4 is involved in the regeneration of acute liver wounds and is a promising biomarker for hepatic disease.

CD26/DPP-4 regulates insulin secretion upon food intake and appears to be related with inflammatory reactions in various pathological processes. In this study, the researchers explored the role of this molecule during injury of the hepatic tissue.

Upon liver lesion, there is an evident reduction of the main liver immune cell population, the Kupffer cells. The researchers observed a correlation between the number of Kupffer cells and the enzymatic activity of CD26/DPP4: when the immune cell population is diminished, there were higher blood levels of CD26/DPP-4 enzymatic activity. This happened both in acute and chronic mouse models of liver injury. Inversely, the levels of enzymatic activity decreased during recovery of the Kupffer cells. This study suggests that the level of CD26/DPP-4 enzymatic activity in the blood might be used as a biomarker and to evaluate the severity of the hepatic lesion.

Duarte, N., Coelho, I., Holovanchuk, D., Inês Almeida, J., Penha-Gonçalves, C., & Paula Macedo, M. (2018). *Dipeptidyl Peptidase-4 Is a Pro-Recovery Mediator During Acute Hepatotoxic Damage and Mirrors Severe Shifts in Kupffer Cells.* **Hepatology Communications, 2**(9), 1080–1094. https://doi.org/10.1002/hep4.1225





Comparison between healthy hepatic tissue (left) and liver wounds (right). Credit: Nádia Duarte, IGC.



RESEARCH

Membrane Traffic

Group Leader | ADRAIN, Colin

Research Interests

Thirty percent of cellular proteins are made, then trafficked in a membranous network – the 'secretory pathway'. We study how membrane protein biogenesis, trafficking or degradation, particularly within secretory organelles called the endoplasmic reticulum (ER) and lysosomes, control homeostasis in cells and organisms.

Regulation of inflammatory signalling by trafficking control. How the secretion of the in-

flammatory cytokine, TNF is regulated by an important molecular assemblage that we identified, called the 'sheddase complex'.

Control of adipose tissue homeostasis. How trafficking control in the secretory pathway in adipocytes mediates metabolic homeostasis.

How the ER folds membrane proteins. The role of a protein complex called the EMC, in membrane protein biogenesis.



Lab Members in 2018

Marina Badenes · Postdoc Miguel Cavadas · Postdoc

Abdulbasit Amin · PhD student, 2016 IBB Ioanna Oikonomidi · PhD student, 2014 IBB

Catarina Gaspar · External PhD student **Emma Burbridge ·** Lab Manager

Érika de Carvalho · Technician | Started in April Inês Félix · Technician | Left in March

Funding

> Fundação para a Ciência e a Tecnologia



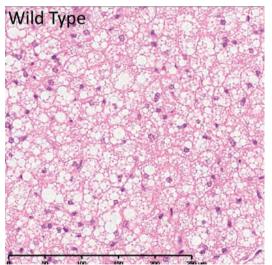
1 – Identification of iTAP as a novel regulator of TNF release. We identified a protein called iTAP, which controls TNF secretion. We showed that iTAP controls the cell surface stability of the 'sheddase complex', an assemblage that includes TACE, the protease that releases TNF from the membrane, and iRhom2, its allosteric regulator. When iTAP is knocked out, the sheddase complex is degraded in lysosomes and TNF signaling is blocked.

2 - Control of adipose tissue homeostasis. (A) We identified a novel function for iRhom2

in the control of adipose tissue physiology in vivo. (B) We generated a novel mouse line mutant in a gene called Ubxd8 which our studies suggest plays a crucial role in adipose tissue homeostasis.

Publications

- Oikonomidi, I., Burbridge, E., Cavadas, M., Sullivan, G., Collis, B., Naegele, H., Clancy, D., Brezinova, J., Hu, T., Bileck, A., Gerner, C., Bolado, A., von Kriegsheim, A. Martin, S. M., Steinberg, F., Strisovsky, K., & Adrain, C. (2018). iTAP, a novel iRhom interactor, controls TNF secretion by policing the stability of iRhom/TACE. *ELife*, 7. https://doi.org/10.7554/eLife.35032
- Adrain, C., Henis-Korenblit, S., & Domingos, P. M.
 (2018). Meeting Report proteostasis in Ericeira.
 Journal of Cell Science, 131(5), jcs216150. https://doi.org/10.1242/jcs.216150



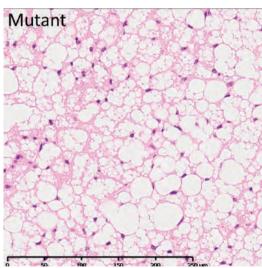


Figure: H & E-stained images of brown adipose tissue (BAT) from wild type (left hand side) or Ubxd8 mutant mice (right hand side). BAT normally has a 'multilocular' appearance characterized by the presence of numerous small lipid droplets per brown adipocyte. By contrast, the brown adipocytes from Ubxd8 mutant mice have lost this hallmark appearance and often have a reduced number of enlarged lipid droplets more characteristic of the white adipose tissue. Image courtesy of Pedro Faísca.

Biophysics and Genetics of Morphogenesis

Group Leader | ALVES, Filipa

Research Interests

Throughout development and growth, gene expression and cell metabolism are regulated both in space and time, leading to complex patterns of cell differentiation from seemingly simpler initial conditions. We use mathematical modelling to study how the dynamic behaviour of key regulatory networks can generate well-defined sharp state transitions in cells, triggered by critical changes in their biophysical parameters.

We are investigating two distinct, yet related, mechanisms:

1) Cells express different genes depending on their spatial location. We are analysing the pigmentation patterning in butterfly wings to investigate how local gene regulation and tissue architecture act together to define organised patterns of cell differentiation and how this interplay both generates and constrains the phenotypic variation observed within and between species.

2) Cells express different genes at different points in time. We are studying the developmental switch of ovary maturation in *Drosophila* as a model system for how the patterning of individual organs is coordinated in time as wholebody development and growth progress and how the regulatory mechanisms involved ensure robustness against environmental and physiological perturbations.





To quantitatively compare our model results with the experimental images, we focused on disentangling distinct quantitative traits from complex patterning phenotypes by developing tailored image analysis methods and parameter optimisation algorithms.

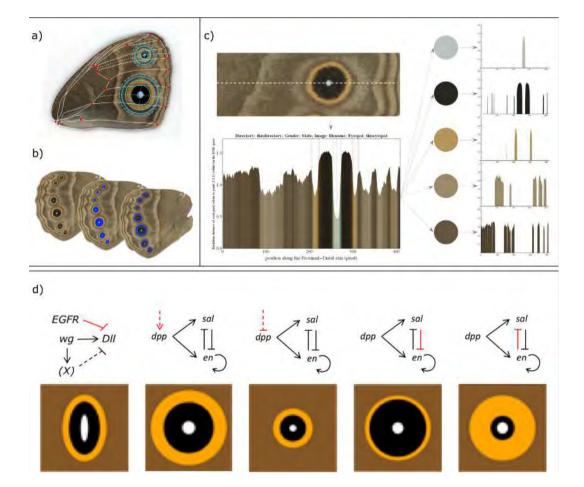


Figure: Patterned cell fate determination in butterfly wings. a) Image analysis: morphometry. b) and c) Colour pattern quantification. d) Candidate gene networks regulating eyespot patterning and examples of results from the theoretical models testing different parameter settings.

Cell Biology of Viral Infection

Group Leader | AMORIM, Maria João

Research Interests

Influenza A virus (IAV) is a major human pathogen. We focus on how IAV modulates the host. In particular we look at viral inducedalterions to cellular architecture, organelle dynamics & function, membrane trafficking and host immunity to assist viral infection. Current projects running in the lab investigate: 1) the formation of liquid

viral inclusions and their role in facilitating the assembly of IAV genomic complex; 2) the effects of neuramindase function inside the host cell and 3) the role of mitochondria in IAV infection. The lab uses in vitro reconstituted systems, cells and the mice model to unravel these outstanding questions in virology.



Lab Members in 2018

Marta Alenquer · Postdoc Sílvia Costa · Postdoc

Temitope Akhigbe Etibor · PhD student, 2017 IBB **Nuno Santos** · PhD student, 2017 PGCD

Zoé Vaz Da Silva · PhD student, 2013 PIBS | Left in February João Diamantino · Masters student | Started in September

Filipe Ferreira · Lab manager

Luka Krampert · Erasmus Student | Left in March

Funding

> Fundação para a Ciência e a Tecnologia



We made considerable progress in understanding:

Viral assembly: IAV genome contains 8 distinct RNA segments (vRNPs), tightly packaged and interlinked in a budding virion. However, the location and mechanism for the genomic complex formation inside the host cell remains unclear. Over the course of infection, influenza forms viral inclusions where the all RNPs are found. Until recently, it was postulated that RNP-RNP interactions were the drivers of viral inclusion formation. We challenged this view and found that viral inclusion formation

precedes and does not require RNP-RNP interactions. We also found that viral inclusions have liquid properties, and assemble close to ER exit sites. We propose that viral inclusions are sites dedicated to the assembly of IAV genome.

Modulation of host innate immunity: Hemagglutinin and neuraminidase are well known viral proteins, being the major antigens in the virion envelope, and known for their roles in viral entry and exit, respectively. We have identified two mechanisms associated with these proteins to attenuate or increase pathogenicity of IAV strains.

Selected Publications*

- Alenquer, M., Vale-Costa, S., Sousa, A. L., Etibor, T. A., Ferreira, F., & Amorim, M. J. (2018). Influenza a virus ribonucleoproteins form liquid organelles at endoplasmic reticulum exit sites. *BioRxiv*. https://doi.org/10.1101/410373
- Nieto, A., Vasilijevic. J., Santos, N. B., Zamarreño, N., Amorim, M. J. and Falcon, A. Mutation S110L of H1N1 influenza virus hemagglutinin: A potent determinant of attenuation in the mouse model. *Frontiers in Immunology* (in press).
- Pereira, C. F., Wise, H. M., Kurian, D., Pinto, R. M., Amorim, M. J., Gill, A. C., & Digard, P. (2018). Effects of mutations in the effector domain of influenza A virus NS1 protein. *BMC Research Notes*, 11(1). https://doi. org/10.1186/s13104-018-3779-6
 - * The complete list of publications is available on section 3. Publications.

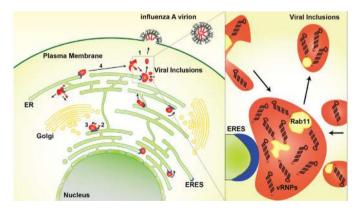


Figure: Influenza A virus forms viral inclusions (in red) that lack a delimitating membrane and have liquid properties, segregating from the cytosol by liquid phase separation. Viral inclusions exchange material dynamically (1) and deform easily exhibiting fission (2) and fusion (3) events. Viral inclusions can travel long distances before and after fusion/fission events (4), respectively. These liquid organelles are formed in the vicinity of Endoplasmic Reticulum Exit Sites (ERES, in blue). Inlet shows composition of viral inclusions close to ERES. These contain vRNPs of all types, Rab11 and host membranes clustered, but are not delimited by lipid bilayer.

Protein — Nucleic Acids Interactions

Group Leader | ATHANASIADIS, Alekos

Research Interests

For the vertebrate innate immune system, nucleic acids represent a major Pathogen Associated Molecular Pattern (PAMP) capable of triggering interferon responses and apoptotic/necroptotic cell death. We are interested in understanding how cells distinguish self-nucleic acids from for-

eign and the molecular mechanisms involved in maintaining homeostatic balance. We are studying the dsRNA sensing pathway and the role of A to I RNA editing to render cellular transcripts non recognizable by the innate immune sensors.



Lab Members in 2018

Bharath Srinivasan · Postdoc Ourania Theologi · Trainee

Funding

> Fundação para a Ciência e a Tecnologia

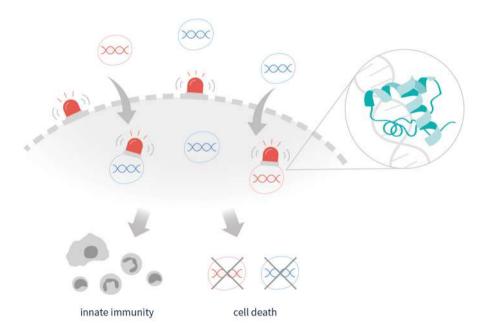


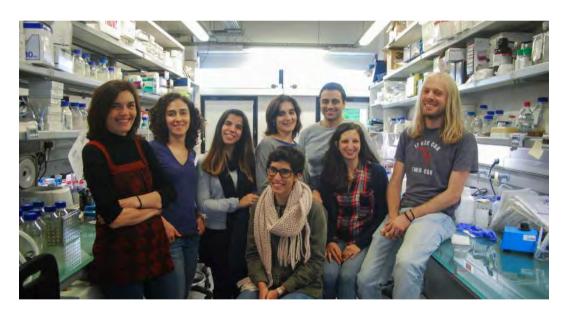
Figure: Innate immunity is the first-line of defence against invading viruses and bacteria. Involved in this process are specialized receptors that recognise pathogen molecular patterns and are capable of among others to detect nucleic acids. However, how exactly foreign nucleic acids (red) are distinguished from host DNA (blue) is poorly understood. Moreover, false recognition may lead to cell death events, often associated with autoinflammatory disorders. We study the molecular mechanisms behind those processes and aim to understand what consequences they might have on molecular evolution dynamics.

Plant Stress Signalling

Group Leader | BAENA GONZÁLEZ, Elena

Research Interests

We are interested on the mechanisms underlying carbon sensing and management in plants at the cellular and whole plant levels. We further seek to understand how carbon management systems interact with other signalling pathways to drive adequate growth and developmental decisions. Our current efforts aim at dissecting the SnRK1 pathway, one of the major players of carbon signalling.



Lab Members in 2018

Ana Confraria · Postdoc
Leonor Margalha · Postdoc
Mattia Adamo · External PhD student
Mónica Costa · PhD student | Started in June
Carlos Elias · PhD student, 2013 PIBS

Filipa Lopes · PhD student **Bruno Peixoto** · PhD student

Diana Reis • Masters student | Left in December **Américo Rodrigues** • Visiting scientist

Borja Belda Palazón · Fellow | Started in February

Funding

> Fundação para a Ciência e a Tecnologia



As part of our efforts to understand how the SnRK1 pathway is regulated we have made progress on two fronts.

Firstly, following up on our previous finding that ABA activates and sustains SnRK1 signaling via inhibition of PP2C phosphatases, we have now found an additional level of crosstalk between these two pathways that is crucial for the regulation of plant growth under optimal conditions and under stress (*in preparation*).

Secondly, using a luciferase-based mutant screen we have identified several factors that influence SnRK1 activity. One such factor is a nuclear pore component that is essential for the nuclear import of SnRK1 in response to energy deficit (e.g. darkness; *in preparation*). Accordingly these mutants are defective in processes

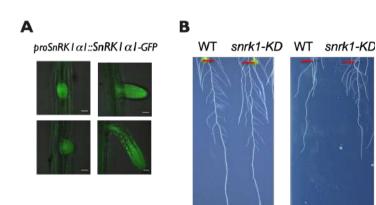
that rely on SnRK1 nuclear activities (e.g. leaf senescence). This highlights the importance of subcellular localization for SnRK1 regulation and underscores the necessity of understanding how complex composition and localization relates to specific functions.

As part of our efforts to understand how SnRK1 regulates gene expression and metabolism, we have shown, in collaboration with the group of Wolfgang Dröge-Laser (Würzburg University, Germany), that SnRK1 is important for the activation of genes involved in branched-chain amino acid catabolism. This constitutes an alternative mitochondrial respiratory pathway that is crucial for plant survival during energy stress.

Publications

- Margalha, L., Confraria, A. and Baena-González, E. (2018) SnRK1 and TOR: modulators of growth-defense trade-offs in plant stress responses. *Journal of Experimental Botany* (submitted)
- Pedrotti, L., Weiste, C., Nägele, T., Wolf, E., Lorenzin, F., Dietrich, K., Dietrich, K., Mair, A., Weckwerth,

W., Teige, M., **Baena-González, E.** & Dröge-Laser, W. (2018). Snf1-RELATED KINASE1-Controlled C/S -bZIP Signaling Activates Alternative Mitochondrial Metabolic Pathways to Ensure Plant Survival in Extended Darkness. *The Plant Cell*, 30(2), 495–509. https://doi.org/10.1105/tpc.17.00414



mock

ABA

Figure: The SnRK1 kinase represses lateral root formation in response to the phytohormone ABA. A, SnRK1 is expressed in the early stages of lateral root development. B, ABA represses to a larger extent lateral root formation in wild-type plants than in plants knocked down for the SnRK1 kinase.

Evolutionary Dynamics

Group Leader | BANK, Claudia

Research Interests

Work in the *Evolutionary Dynamics* Group is focused on the study of evolution, and in particular on the population genetics of adaptation and speciation. Questions at the interface between

theoretical and empirical biology are approached through theoretical modelling, computational methods, and statistical data analysis, and via targeted collaborations with wet-lab researchers.



Lab Members in 2018

Alexandre Blanckaert · Postdoc

Inês Fragata • Postdoc

Massimo Amicone · PhD student, 2018 IBB | Started in February

Ana-Hermina Ghenu · PhD student, 2017 IBB

Marco Louro · PhD student, 2017 IBB

Manuel Fortunato · Master student | Started in October

Mark Schmitz · Programmer

Emma Berdan · Visiting postdoc | Started in February, left in March Sofia Torres · Summer intern | Started in August, left in September

Funding

> ERA-NET | European Comission

Software Development

empiricIST: a software that allows for accurate estimation of growth rates and credibility intervals from bulk competitions. empiricIST is an integrative framework for the analysis of bulk competition data, and includes separate programs for identifying outliers, obtaining statistically meaningful estimates of selection coefficients in a fast and efficient manner, and for providing ready-to-use summary statistics of the MCMC analysis and its associated parameter estimates. https://github.com/Matu2083/empiricIST



In search of the Goldilocks zone for hybrid speciation. Whether hybridization can be an engine for speciation is hotly debated. We determined the probability of homoploid hybrid speciation in a minimal model. We demonstrated that the location and order of the genetic changes involved in speciation critically determines whether hybrid speciation is impossible or highly probable. Moreover, we refuted the common assumption that a symmetric contribution from both parental species maximizes the probability for hybrid speciation.

Conflict between heterozygote advantage and hybrid incompatibility in haplodiploids (and sex chromosomes). We developed mathematical models to compare the evolutionary dynamics of hybrid populations of diploid and haplodiploid organisms. We showed that the evolutionary outcomes between genetic systems are dramatically different. Our results imply a specific signature of hybrid incompatibilities in haplodiploids. This, in turn, provides an alternative hypothesis why X chromosomes in diploids may appear as hotspots of speciation genes and sexual conflict.

Selected Publications*

- Blanckaert, A., & **Bank**, **C**. (2018) In search of the Goldilocks zone for hybrid speciation. *PLOS Genetics*, 14(9), e1007613. https://doi.org/10.1371/journal.pgen.1007613
- Fragata, I., Matuszewski, S., Schmitz, M. A., Bataillon, T., Jensen, J. D., & Bank, C. (2018). The fitness landscape of the codon space across environments. Heredity, 121(5), 422–437. https://doi.org/10.1038/s41437-018-0125-7
- Ghenu, A.-H., Blanckaert, A., Butlin, R. K., Kulmuni, J., & Bank, C. (2018). Conflict between heterozygote advantage and hybrid incompatibility in haplodiploids (and sex chromosomes). *Molecular Ecol*ogy, 27(19), 3935–3949. https://doi.org/10.1111/ mec.14482
 - * The complete list of publications is available on section 3. Publications.

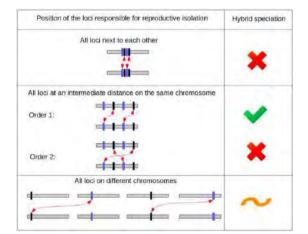


Figure: The probability of hybrid speciation, which is the formation of a third species as a result of hybridization between two parental species, is strongly dependent on the specific order and positioning of the genes responsible for reproductive isolation along the genome. Here, the green checkmark indicates a scenario in which hybrid speciation is highly likely, the orange tilde that is unlikely and the red crosses that is extremely unlikely. It is surprising that only a slight change in the ordering of the loci on a chromosome can change the hybrid speciation probability dramatically; this result was revealed through building a minimal model and the use of computer simulations. The red arrows indicate the interacting loci of two hybrid incompatibilities. We represented here only two of the six possible orderings of the four loci. (Image from https://sciencetrends.com/hybrid-speciation-when-two-species-become-three/)





Plant Genomics

Group Leader | BECKER, Jörg

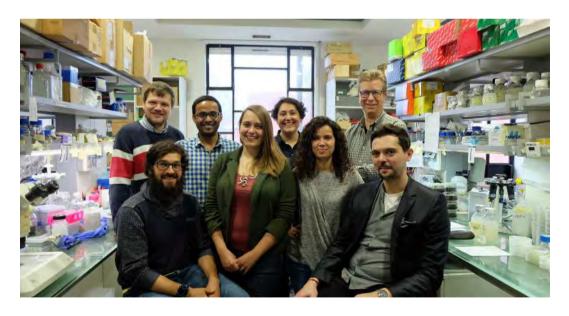
Research Interests

Our group is interested in mechanisms controlling sexual reproduction and early embryogenesis. We are primarily studying these processes in two plant model species: The angiosperm *Arabidopsis thaliana* and the extant bryophyte *Physcomitrella patens*.

A particular focus of our work lies on (epi)genetic mechanisms acting during male gametogenesis. In *Arabidopsis*, the development of the male gametophyte involves reprogramming events at both genetic and epigenetic level, leading to a very distinct transcriptome in male gametes, ac-

companied by alterations in their epigenetic landscape with far-reaching implications for transposon silencing and transgenerational inheritance. We are analyzing how these changes come about and what are their potential consequences after fertilization.

Using the moss *Physcomitrella patens* we are not only studying the evolution of (epi)genetic mechanisms governing male gametogenesis, but also processes unique to sperm cells of early land plants, namely *de novo* centriole biogenesis and regulation of sperm motility.



Lab Members in 2018

Ann-Cathrin Lindner · Postdoc | Left in September

Paulo Navarro Costa · Postdoc

Armin Horn · PhD student | Started in April
Anton Kermanov · PhD student, 2017 IBB
Carmen Santana · PhD student | Started in February

Chandra Shekhar Misra · PhD student Patrícia Pereira · PhD student Sónia Pereira · PhD student, 2017 IBB Mário Santos · Lab manager Rui Martinho · Visitor



We have developed a method combining semi *in vivo* pollen tube growth with FACS sorting to isolate *Arabidopsis* sperm cells for single cell transcriptome analysis (Misra et al., Transcriptomics of *Arabidopsis* sperm cells at

single-cell resolution, *Plant Reproduction*, (in press). Potential heterogeneous expression in the 80 single sperm cell transcriptomes obtained in this way is being analyzed.

Selected Publications*

- Misra, C. S., Santos, M. S., Rafael-Fernandes, M., Martins, N. P., Monteiro, M., Becker, J. D. Transcriptomics of *Arabidopsis* sperm cells at single-cell resolution. *Plant Reproduction (in press)*.
- Prudêncio, P., Guilgur, L. G., Sobral, J., Becker, J. D., Martinho, R. G., & Navarro-Costa, P. (2018). The Trithorax group protein dMLL3/4 instructs the assembly of the zygotic genome at fertilization. *EMBO Reports*, 19(8), e45728. https://doi.org/10.15252/embr.201845728
- Ferrari, C., Proost, S., Janowski, M., **Becker, J.**, Nikoloski, Z., Bhattacharya, D., Price, D., Tohge, T., Bar-Even, A., Fernie, A., Stitt, M., & Mutwil, M. (2018). Kingdom-wide comparison reveals conserved diurnal gene expression in Archaeplastida. *BioRxiv*. https://doi.org/10.1101/387316
 - * The complete list of publications is available on section 3. Publications.

Funding

- > Fundação para a Ciência e a Tecnologia
- > European Commission



Figure: Mature sporophyte of the moss Physcomitrella patens.

Variation: Development and Selection

Group Leader | BELDADE, Patrícia

Research Interests

Our Eco-Evo-Devo research combines concepts and approaches from different disciplines to characterise genetic and environmental factors accounting for intra-specific variation, the raw material for natural selection and a universal property of biological systems. Understanding the mechanisms that generate this variation is a key challenge. What are the genetic changes that contribute to evolutionarily relevant variation? How do they interact with environmental factors to regulate developmental trajectories and outcomes? For the dissection of variation in complex, diversified, and ecologically-relevant traits, the lab uses two complementary models: Bicyclus anymana butterflies and Drosophila melanogaster flies.



Lab Members in 2018

Roberto Arbore · Postdoc | Started in September Erik van Bergen · Postdoc | Left in February Nuno Silva-Soares · Postdoc | Started in May João Gonçalves · Visiting Postdoc | Started in July, left in November Ana Teresa Eugénio · PhD student, 2017-2018 IBB

Elvira Lafuente · PhD student, 2013 PIBS | Left in February

Yara Rodrigues · PhD student, 2015 PGCD Cátia Patrício · Technician | Started in July Carolina Silva · Technician | Left in July

Funding

› Fundação para a Ciência e a Tecnologia



In 2018, the lab continued to focus on developmental plasticity, the property by which phenotype expression is affected by the conditions experienced during development. By focusing on *D. melanogaster* body size and pigmentation, we identified genes that contribute to variation in their thermal plasticity and can be targets of natural selection during its evolution. By focusing on thermal plasticity in *B. anynana*, we studied the combined effects of

developmental and adult environments on different traits. We confirmed our hypothesis that plasticity in pigmentation should be matched by plasticity in an adult behaviour that presumably aids its effectiveness in predator avoidance. We also confirmed our hypothesis that known plasticity in strategies for survival and reproduction should include plasticity in how prepared adults are to deal with bacterial infection.

Selected Publications*

- Lafuente, E., Duneau, D., & Beldade, P. (2018). Genetic basis of thermal plasticity variation in *Drosophila mel*anogaster body size. *PLOS Genetics*, 14(9), e1007686. https://doi.org/10.1371/journal.pgen.1007686
- Rodrigues, Y. K., van Bergen, E., Alves, F., Duneau, D., & **Beldade**, **P**. (2018). Complex effects of day and night temperature fluctuations on thermally plastic traits in a seasonal plasticity model. *BioRxiv*. https://doi.org/10.1101/207258
- van Bergen, E., & Beldade, P. (2018). Seasonal plasticity for anti-predatory strategies: matching colour and colour preference for effective crypsis. *BioRxiv*. https://doi.org/10.1101/253906
 - * The complete list of publications is available on section 3. Publications.

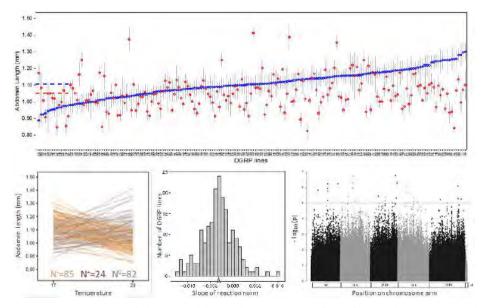


Figure: Natural genetic variation for body size and thermal plasticity in body size (from Lafuente et al. PLOS Genetics 2018).

Cell Cycle Regulation

Group Leader | BETTENCOURT DIAS, Mónica

Research Interests

Our laboratory is interested in general principles in biology regarding the counting and assembling of complex subcellular structures, and their variations observed during development, in disease and evolution. We use complex cytoskeletal assemblies, such as centrioles and cilia, as study subjects. We follow three complementary research lines in their output: mechanisms of biogenesis and function, disease (cancer) and evolution.



Lab Members in 2018

Daisuke Ito · Postdoc Swadhin Jana · Postdoc Carla Lopes · Postdoc

Nuria Marin · Postdoc | Started in October

Ana Rita Marques · Postdoc

Gaëlle Marteil · Postdoc | Left in September
Tânia Perestrelo · Postdoc | Started in September
Zitouni Sihem · Postdoc | Left in November

Irina Fonseca · PhD student, 2017 PGCD

Funding

- > Fundação para a Ciência e a Tecnologia
- > European Research Council

Marco Louro · PhD student, 2017 IBB Catarina Nabais · PhD student, 2014 IBB

Catarina Peneda · PhD student **Sónia Pereira** · PhD student, 2017 IBB

Leonor Nunes · Masters student | Started in September **Patrícia Rodrigues** · Masters student | Left in September

Mariana Faria · Lab Manager Paulo Duarte · Technician

Marta Mesquita · Visitor | Left in January

Ksenia Volkova · Trainee



We suggest a new mechanism of action for PLK4, where it forms a self-organising catalytic scaffold that recruits centriole components,

PCM factors and α - and β - tubulins, leading to MTOC formation. These studies were recently published in *JCS* (Montenegro Gouveia, Zitouni et al., *JCS*, 2018)

Using an heterologous expression system for centriole components, the fission yeast, that is devoid of centrioles, we dissected a role for the PCM in centriole assembly. We showed that Pcp1/Pericentrin recruits a critical centriole constituent, SAS-6 and this interaction is conserved and important for centriole biogenesis and elongation in animals. This study reveals an ancestral relationship between pericentrin and the centriole, where both regulate each other assembly, ensuring mutual localisation. https://www.biorxiv.org/content/early/2018/05/03/313494

Selected Publications*

- Jana, S. C., Mendonça, S., Machado, P., Werner, S., Rocha, J., Pereira, A., Maiato, H., & Bettencourt-Dias, M. (2018). Differential regulation of transition zone and centriole proteins contributes to ciliary base diversity. *Nature Cell Biology*, 20(8), 928–941. https://doi.org/10.1038/s41556-018-0132-1
- Lopes, C. A. M., Mesquita, M., Cunha, A. I., Cardoso, J., Carapeta, S., Laranjeira, C., Pinto, A. E., Pereira-Leal, J. B., Dias-Pereira, A., Bettencourt-Dias, M., & Chaves, P. (2018). Centrosome amplification arises before neoplasia and increases upon p53 loss in tumorigenesis. *The Journal of Cell Biology*, 217(7), 2353–2363. https://doi.org/10.1083/jcb.201711191
- Marteil, G., Guerrero, A., Vieira, A. F., de Almeida, B. P., Machado, P., Mendonça, S., Mesquita, M., Villarreal, B., Fonseca, I., Francia, M.E., Dores, K., Martins, N.P., Jana, S. C., Tranfield, E. M., Barbosa-Morais, N. L., Paredes, J., Pellman, D., Godinho, S. A., & Bettencourt-Dias, M. (2018). Over-elongation of centrioles in cancer promotes centriole amplification and chromosome missegregation. *Nature Communications*, 9(1). https://doi.org/10.1038/s41467-018-03641-x
- * The complete list of publications is available on section 3. Publications.

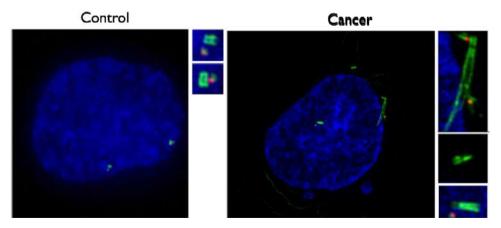


Figure: Cancer cells often have abnormal centrioles, which are longer, can form more than one daughter centriole and can fragment (from Marteil et al, *Nature Communications*, 2018).

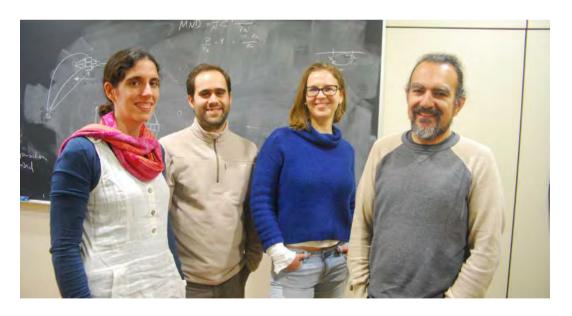
Quantitative Organism Biology

Group Leader | CARNEIRO, Jorge

Research Interests

Cells of multicellular organisms cooperate to ensure body development and maintenance throughout life. They do this in a collective distributed manner, without any master or plan. The Quantitative Organism Biology group studies the multilevel mechanisms that give rise to properties of the whole organism, in search for general principles of biological organisation and, eventually, the design of artificial systems. One of our main research interests is the immune system, in which cells collectively ensure body housekeeping

and homeostasis, avoid autoimmune diseases, and fight cancer and infections. We also investigate the morphodynamics of cells and tissues with special focus in fertilisation. Our approach is two fold: on the one hand, we create mathematical models of specific exemplary systems aiming to uncover basic principles, and on the other hand, we develop the quantitative methods required to assess the properties and predictions of these models.



Lab Members in 2018

Pedro Angelo Silva · Postdoc | Left in March Delphine Pessoa · PhD student, 2014 IBB Eleonora Tulumello · PhD student, 2015 IBB



Cell populations are inherently heterogeneous, especially in terms of the variation in copy number of any specific protein or mRNA. An important cause of this variation is the fluctuations in expression levels arising from the stochastic cellular biochemistry. In face of this pervasive variation, it is utterly puzzling that some cellular processes can produce a single copy per cell. Examples of such exceptionally efficient processes are allelic exclusion of the antigen receptors in lymphocyte precursors and X chromosome inactivation (XCI) in female stem cells. We developed a general quantitative framework to disentangle how much of the observed efficiency in product number control is achieved by the cellular biochemistry

itself - through tight regulation of biosynthesis rates – and how much can be attributed to cell selection - where cells that fail to achieve the correct number are eliminated or diluted. Empowered by this framework we analysed and compared the processes VDJ recombination and XCI to conclude that the efficiency of the former is mostly explained by cellular selection, while the latter is predominantly explained by biochemical control. For this work, Delphine Pessoa was awarded a first prize for student poster session at the 11th European Conference on Mathematical and Theoretical Biology held in Lisbon in July and also at 17th European Conference on Computational Biology held in Athens in September.

Publications

- Mendes, N. D., Henriques, R., Remy, E., Carneiro, J., Monteiro, P. T., & Chaouiya, C. (2018). Estimating Attractor Reachability in Asynchronous Logical Models. Frontiers in Physiology, 9. https://doi.org/10.3389/ fphys.2018.01161
- Priego-Espinosa, D. A., Darszon, A., Guerrero, A., González-Cota, A. L., Nishigaki, T., Martínez-Mekler, G., & Carneiro, J. (2018). Modular mathematical analysis of the control of flagellar Ca2+-spike trains produced by CatSper and CaV channels in sea urchin sperm. *BioRxiv.* https://doi.org/10.1101/415687

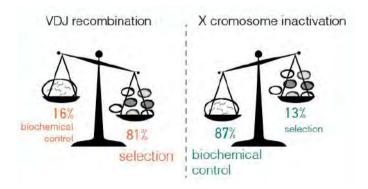


Figure: Illustration of the relative importance of biochemical control and selection in making a single product of VDJ recombination (left) and X chromosome inactivation (right) processes.

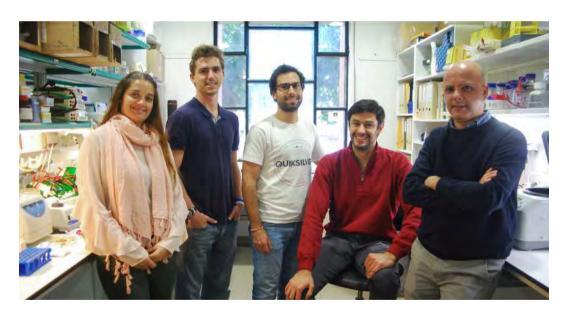
Molecular Neurobiology

Group Leader | CASTRO, Diogo S.

Research Interests

The Molecular Neurobiology lab works on transcriptional mechanisms that regulate vertebrate neurogenesis, with a particular emphasis on pathways that govern the balance between maintenance and differentiation of neural stem/progenitor cells. Our work has also significant implications in the field of neuronal reprogramming, where developmental regulators are often used to

override the identity of somatic cells. Moreover, we also seek to understand how the same mechanisms may be deployed in pathological situations. For this, we focus on glioblastoma, a brain tumor whose growth is sustained by a population of cancer stem-like cells that share many similarities with neural stem/progenitors.



Lab Members in 2018

Pedro Rosmaninho · Postdoc | Left in March Abeer Heskol · PhD student, 2018 IBB | Started in April André Madaleno · PhD student, 2017 IBB

Mário Soares · PhD student, 2017

Diogo Soares · Masters student Vera Teixeira · Lab manager Alexandre Raposo · Visitor

Funding

> Fundação para a Ciência e a Tecnologia



Glioblastoma is the most common and aggressive brain tumor in adults, and is characterized by single malignant cell invasion of the brain parenchyma. We have recently shown that the EMT factor Zeb1 regulates an EMT-like program in glioblastoma. Contrary to the common view that EMT factors act as transcriptional repressors, we uncover a novel mechanism whereby Zeb1 promotes gene acti-

vation genome-wide, in synergy with Lef1/Tcf factors. Amongst genes activated by Zeb1 are predicted mediators of tumor cell migration and invasion, many of which correlate with Zeb1 expression in patient tumor samples. Overall, our work identified novel mediators of glioblastoma tumor invasion, while providing an important basis for how EMT factors can coordinate such complex genetic programs.

Publications

- Rosmaninho, P., Mükusch, S., Piscopo, V., Teixeira,
 V., Raposo, A. A., Warta, R., Bennewitz, R., Tang, Y.,
 Herold-Mende, C., Stifani, S., Momma, S., & Castro,
 D. S. (2018). Zeb1 potentiates genome-wide gene transcription with Lef1 to promote glioblastoma cell invasion. *The EMBO Journal*, 37(15), e97115. https://doi.org/10.15252/embj.201797115
- Yang, S., Toledo, E. M., Rosmaninho, P., Peng, C., Uhlén, P., Castro, D. S., & Arenas, E. (2018). A Zeb2miR-200c loop controls midbrain dopaminergic neu-
- ron neurogenesis and migration. *Communications Biology*, *1*(75). https://doi.org/10.1038/s42003-018-0080-0
- Soares, M. A. F., & Castro, D. S. (2018). Chromatin Immunoprecipitation from Mouse Embryonic Tissue or Adherent Cells in Culture, Followed by Next-Generation Sequencing. In N. Visa & A. Jordán-Pla (Eds.), *Chromatin Immunoprecipitation* (Vol. 1689, pp. 53–63). New York, NY: Springer New York. https://doi.org/10.1007/978-1-4939-7380-4_5

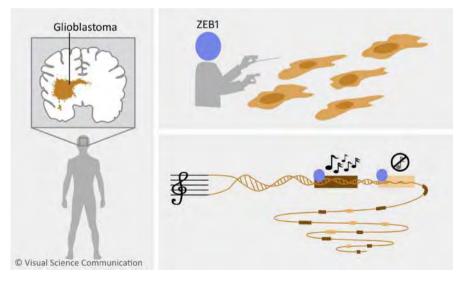


Figure: ZEB1 is able to simultaneously switch "on" and "off" a large number of genes in cancer cells, in this way functioning as a "conductor" that coordinates a genetic program that drives cell invasiveness of glioblastoma tumors. Credits: Visual Science Communication.

Network Modelling

Group Leader | CHAOUIYA, Claudine

Research Interests

Complementary to experimental approaches, mathematical models allow to get further insights into the functioning of complex regulatory networks and to formulate hypotheses, e.g. identify proper strategies to enforce or prevent certain behaviours. We mainly rely on a discrete, logical framework, which can uncover key characteristics

of the dynamics of such networks. Our activity is organised along three lines: 1) Theoretical work with the definition of efficient methods for the analysis of large models; 2) Computational work with the development of software tools; 3) Modelling work with the study of specific networks, in collaboration with experimentalists.



Lab Members in 2018

Sara Canato · Postdoc | Started in June Gianluca Selvaggio · Postdoc Ana Morais · PhD student, 2016 IBB Ricardo Pais · PhD student, 2013 PIBS Jorge Pereyra · PhD student Pedro Varela · PhD student

Abdelmounim Essabbar • Technician | Started in May,

left in November

Tiago Pedreira · Technician | Left in March Mehran Piran · Technician | Started in January

Pedro Monteiro · Visitor

Software Development

- **GINsim**: supports the definition and analysis of logical models of regulatory/signaling networks. This tool is in constant development, implementing most of our methodological advances. http://ginsim.org/
- > EpiLog: supports the extension of the logical modelling approach to multi-cellular systems represented as hexagonal grids of communicating cells. We have recently implemented stochastic updating modes to overcome the inherent synchrony of cellular automata. http://epilog-tool.org



The 3rd official version of GINsim has been released (http://ginsim.org/). This new version of our software for the definition and analysis of logical models provides various novel features, including the implementation of algorithms recently finalised for the identification and reachability quantification of attractors (Mendes *et al.* 2018). EpiLog first official version has been released (http://epilog-tool.org/, Varela *et al.* 2018 -a). This software tool supports the definition and simulation of logical models over hexagonal grids of cells, implementing in the

form of cellular automata the first extension of the logical framework to support multi-cellular systems. In this respect, a theoretical study of the number of stable patterns in such hexagonal grids has been published (Varela *et al.* 2018 -b). With our collaborator Lucas Sánchez from CIB-CSIC (Madrid), we have finalised our work on primary sex determination of chicken (Sánchez, Chaouiya 2018). This work complements our previous achievements in considering the regulatory control of primary sex determination of placental mammals.

Selected Publications*

- Sánchez, L., & Chaouiya, C. (2018). Logical modelling uncovers developmental constraints for primary sex determination of chicken gonads. *Journal of The Royal Society Interface*, 15(142), 20180165. https://doi. org/10.1098/rsif.2018.0165
- Mendes, N. D., Henriques, R., Remy, E., Carneiro, J., Monteiro, P. T., & Chaouiya, C. (2018). Estimating Attractor Reachability in Asynchronous Logical Models.

Frontiers in Physiology, 9. https://doi.org/10.3389/fphys.2018.01161

- Varela, P. L., Ramos, C. V., Monteiro, P. T., & Chaouiya,
 C. (2018). EpiLog: A software for the logical modelling of epithelial dynamics. F1000Research, 7, 1145. https://doi.org/10.12688/f1000research.15613.1
- * The complete list of publications is available on section 3. Publications.

Funding

› Fundação para a Ciência e a Tecnologia

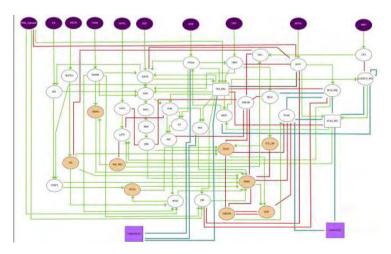


Figure: Screenshot of GINsim's main window, displaying the regulatory graph controlling adhesion properties of epithelial cells.

Email · chaouiya@igc.gulbenkian.pt
IGC Webpage · http://www.igc.gulbenkian.pt/cchaouiya
External Website · http://compbio.igc.gulbenkian.pt/nmd/





Population and Conservation Genetics

Group Leader | CHIKHI, Lounès

Research Interests

We are interested in the way genetic and genomic data are influenced by the recent evolutionary history of species. The amount of genetic diversity and the differentiation observed today between populations is the result of a complex history that includes demographic events such as population collapses, expansions, or admixture. This also includes spatial processes whereby populations may go through periods of connectivity or disconnection.

To study this, we develop new and use/test existing methods to improve our understanding of the recent evolutionary history of species. We also, and crucially, want to understand the limits of genetic or genomic data as inferential tools. Ap-

plications go from human evolution (e.g. the Neolithic transition in Europe, or the recent history of humans and Neanderthals) to conservation genetics of wild (e.g. orang-utans, lemurs, dolphins) and domesticated species (e.g. cattle, sheep).

Our work involves fieldwork in Madagascar, Guinea-Bissau and Portugal, and the genetic and genomic typing of endangered species, data analysis and simulation. We collaborate with the lab. Evolution & Diversité Biologique, in Toulouse, where Lounès Chikhi is a Senior researcher (Directeur de Recherche) and with various institutions, including several in Portugal, the UK, Germany, France, Madagascar, or Malaysia.



Lab Members in 2018

Inês Carvalho · Postdoc Bárbara Parreira · Postdoc Tânia Rodrigues · Postdoc

Gabriele Sgarlata · PhD student, 2016 IBB

Barbara Le Pors · Technician

Adam Marques · Technician | Left in October Tiago Maié · Trainee | Left in December Filipa Borges · Visitor | Started in July

Patricia Santos · Visitor

Beatriz Mourato · NOS Alive fellow | Started in December



In 2016 our group, in collaboration with colleagues from Toulouse, introduced the notion of IICR (inverse instantaneous coalescence rate), which allows to look at genomic data in a new way, questioning some interpretation of genomic data. In 2018 with the same colleagues from Toulouse we have published several articles that continue that work on the IICR and study its properties. We have applied that work to humans and Neanderthals and shown that current models of admixture cannot explain some patterns of genomic diversity, whereas some models without admixture can. While we do not claim that there was no admixture between humans and Neanderthals

we demonstrate that current models fail to provide a good understanding of human and Neanderthal evolution. A significant re-appraisal is thus necessary. We suggest that population structure as identified by the IICR is a serious requirement. In 2018 our group was also involved in a major review involving a multi-disciplinary team led by Eleanor Scerri, then at Oxford University. This review, published in *TREE* discusses the importance of integrating population structure in human evolution, and strongly favours a model in which the whole African continent was involved in the makeup of human genetic diversity, not just a small region in Eastern or Southern Africa.

Selected Publications*

- Chikhi, L., Rodríguez, W., Grusea, S., Santos, P., Boitard, S., & Mazet, O. (2018). The IICR (inverse instantaneous coalescence rate) as a summary of genomic diversity: insights into demographic inference and model choice. *Heredity*, 120(1), 13–24. https://doi.org/10.1038/s41437-017-0005-6
- Scerri, E. M. L., Thomas, M. G., Manica, A., Gunz, P., (...) & Chikhi, L. (2018). Did Our Species Evolve in Subdivided Populations across Africa, and Why Does It Matter? *Trends in Ecology & Evolution*, 33(8), 582–594. https://doi.org/10.1016/j.tree.2018.05.005
- Rodríguez, W., Mazet, O., Grusea, S., Arredondo, A., Corujo, J. M., Boitard, S., & **Chikhi, L.** (2018). The IICR and the non-stationary structured coalescent: towards demographic inference with arbitrary changes in population structure. *Heredity*, 121(6), 663–678. https://doi.org/10.1038/s41437-018-0148-0
 - * The complete list of publications is available on section 3. Publications.

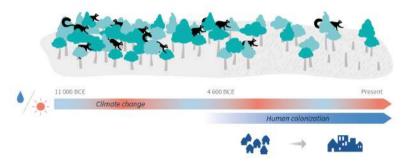


Figure: Lemurs are an endangered group that only exists in Madagascar. Our recent study shows that the connectivity and population size of two species of lemurs were greatly affected by climate changes events that occurred around 4200 years ago. Subsequent human settlements also played a role in deforestation, contributing to a fragmented habitat for lemurs.

Funding

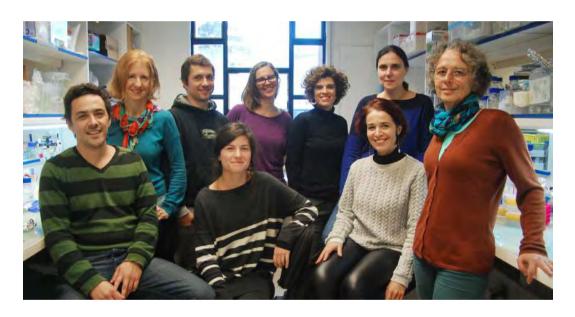
- Fundação para a
 Ciência e a Tecnologia
- > ERA-NET Cofund | European Commission

Lymphocyte Physiology

Group Leader | DEMENGEOT, Jocelyne

Research Interests

We address the fundamental mechanisms of immune regulation, and their dysfunction in the context of autoimmune diseases, cancer and immune therapies, in mice and humans.



Lab Members in 2018

Íris Caramalho · Postdoc

Vital Domingues · PhD student, 2015 IBB
José Santos · PhD student, 2014 IBB
Vânia Silva · PhD student, 2013 PIBS
Eleonora Tulumello · PhD student, 2015 IBB
Marie Louise Bergman · Lab manager

Inês Cabral · Technician Francisca Fontes · Visitor Sandra Gama · Visitor Paula Matoso · Visitor Ricardo Paiva · Visitor

Funding

- › Association Française Contre les Myopathies
- > European Federation for the Study of Diabetes
- Consortium Harvard Medical School Fundação para a Ciência e a Tecnologia
- Maratona da Saúde
- › Sponsor Research agreement, Hospital Garcia de Orta



Previous to this reporting period, we had put forward the concept and documented a developmental time window for T cells to acquire a regulatory phenotype, a finding we published in 2013. This year we further explored the impact of this restriction in the context of tumor immune-surveillance (ongoing PhD project and manuscripts in preparation).

We also pursued our recent investigation into what specifies which organs and tissues are targeted in autoimmunity. We explore the hypothesis that the target tissue may participate in its own demise. We gathered the first data related to a novel research program where we interrogate genetic components in immune regulation vs. disease specific genetic architecture in autoimmune diseases. We initiated this program by investigating the genetic basis of early onset Type 1 diabetes (EOT1D, ≤ 5 years of age) which, when compared to later onset T1D, appears more severe, more frequently associated with other autoimmune diseases, and more often a product of familial autoimmunity.

In each of these settings, our work highlights inter-individual variation as a biological relevant phenomenon to be further dissected.

Selected Publications*

- ok Keppner, L., Heinrichs, M., Rieckmann, M., Demengeot, J., Frantz, S., Hofmann, U., & Ramos, G. (2018). Antibodies aggravate the development of ischemic heart failure. *American Journal of Physiology-Heart* and Circulatory Physiology, 315(5), H1358–H1367. https://doi.org/10.1152/ajpheart.00144.2018
- Agua-Doce, A., Caridade, M., Oliveira, V. G., Bergman, L., Lafaille, M. C., Lafaille, J. J., **Demengeot, J.**, & Graca, L. (2018). Route of Antigen Presentation Can Determine the Selection of Foxp3-Dependent or
- Foxp3-Independent Dominant Immune Tolerance. *The Journal of Immunology*, 200(1), 101–109. https://doi.org/10.4049/jimmunol.1601886
- Garcês, S., & Demengeot, J. (2018). The Immunogenicity of Biologic Therapies. In L. Puig & W. Gulliver (Eds.),
 Current Problems in Dermatology (Vol. 53, pp. 37–48).
 S. Karger AG. https://doi.org/10.1159/000478077
 - * The complete list of publications is available on section 3. Publications.

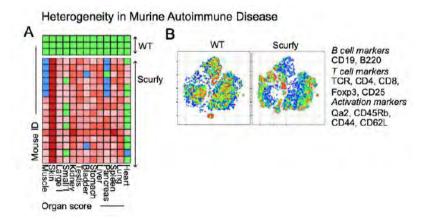


Figure: Histo-pathological and cellular analysis. A) Organs from WT and scurfy mice were fixed, stained and analyzed for tissue destruction and immune cell infiltrates. Blue – Not Analyzed, Green – Healthy, Intensity of Red indicates an increasing disease score. B) Immunophenotyping. Cellular analysis of lymphocyte populations using Flow Cytometry and FlowJo.

Obesity

Group Leader | DOMINGOS, Ana I.

Research Interests

Our laboratory investigates the neuroimmune mechanisms underlying obesity. We focus on sympathetic neurons that innervate the adipose tissue as they have the capacity to drive fat mass reduction. We aim at understanding the biology of these neurons so that we can pave the way to the development of anti-obesity therapies.



Lab Members in 2018

Chelsea Larabee · Postdoc Noelia Martínez-Sánchez · Postdoc Elsa Seixas · Postdoc | Left in February Inês Mahú · PhD student, 2014 IBB

Roksana Pirzgalska · PhD student | Left in February

Bernardo Arús · Masters student

Miguel Costa · Masters student | Left in August **Francesco Diversi** · Masters student | Left in June Vitka Gres · Technician | Left in April Raquel Mendes · Technician Imogen Morris · Technician | Left in April

Ana Carolina Temporão · Technician | Started in April,

left in December

Andreia Barateiro · Visitor Miguel Vasques · Visitor

Publications

- Pirzgalska, R. M., & Domingos, A. I. (2018). Macrophages in obesity. *Cellular Immunology*, 330, 183–187. https://doi.org/10.1016/j.cellimm.2018.04.014
- Schneeberger, M., Tan, K., Nectow, A. R., Parolari, L., Caglar, C., Azevedo, E., Li, Z., Domingos, A., & Friedman, J. M. (2018). Functional analysis reveals differential effects of glutamate and MCH neuropeptide
- in MCH neurons. *Molecular Metabolism, 13*, 83–89. https://doi.org/10.1016/j.molmet.2018.05.001
- Zufall, F., & Domingos, A. I. (2018). The structure of Orco and its impact on our understanding of olfaction. *The Journal of General Physiology*, 150(12), 1602–1605. https://doi.org/10.1085/jgp.201812226

Funding

- > Howard Hughes Medical Institute
- > Welcome Trust
- > European Molecular Biology Organization
- > Human Frontier Science Program
- > Fundação Calouste Gulbenkian

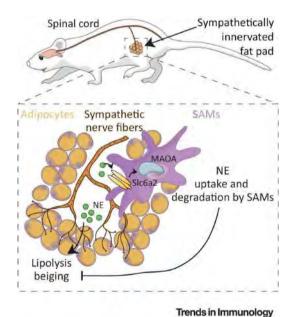


Figure: Sympathetic nerves innervate white adipose tissue in peripheral fat pads. Sites of nerve innervation contain sympathetic-neuron associated macrophages (SAMs). As nerve fibers release NE, it is taken up by Slc6a2 transporters on the SAM surface and degraded by MAOA. Uptake of NE by SAMs inhibits lipolysis and thus can control fat-dependent thermal regulation and gross body weight. Abbreviations: MAOA, monoamine oxidase A; NE, norepinephrine; SAM, sympathetic neuron-associated macrophage.

Plant Molecular Biology

Group Leader | DUQUE, Paula

Research Interests

Our group uses *Arabidopsis thaliana* as a model system to investigate how plants perceive and respond to environmental stress at the molecular level. We focus on the role of alternative splicing, a key posttranscriptional mechanism likely to contribute to the stress tolerance essential for plant survival.

Another major line of work in the lab is uncovering roles for transporters of the Major Facilitator Superfamily (MFS) in plant abiotic stress responses. Interestingly, the functional analysis of these membrane proteins has also revealed striking examples of the biological impact of alternative splicing in plants.



Lab Members in 2018

Tom Laloum · Postdoc
Guiomar Martín · Postdoc
Esther Novo Uzal · Postdoc
Dale Richardson · Postdoc | Left December
Dóra Szakonyi · Postdoc
Alba Rodríguez-Díez · PhD student, 2016 IBB

María Niño-González · PhD student Rui Albuquerque-Martins · PhD student José Pedro Melo · PhD student | Started in June

Vera Nunes · Technician

Beatriz Capitão · Trainee | Started in September

Funding

> Fundação para a Ciência e a Tecnologia



To gain insight into the biological relevance of alternative splicing in plants, we are using reverse genetics to analyze the physiological roles of the conserved SR protein family of key alternative splicing modulators. Strikingly, loss of function of most *Arabidopsis* SR proteins causes impaired responses to abiotic stress during the first steps of plant development and altered sensitivity to the abscisic acid (ABA) stress hormone, suggesting that

alternative splicing controls plant stress tolerance during early plant growth by targeting components of the ABA signaling pathway.

In 2018, our team also uncovered the functions of two novel plant MFS transporters, involved in the response to iron deprivation and cold stress, and discovered two upstream Open Reading Frames (uORFs) controlling translation of an *Arabidopsis* MFS transporter conferring heavy metal tolerance.

Publications

- > Szakonyi, D., & Duque, P. (2018). Alternative Splicing as a Regulator of Early Plant Development. Frontiers in Plant Science, 9. https://doi.org/10.3389/ fpls.2018.01174
- Laloum, T., Martín, G., & **Duque**, **P.** (2018). Alternative Splicing Control of Abiotic Stress Responses. *Trends in Plant Science*, 23(2), 140–150. https://doi.org/10.1016/j.tplants.2017.09.019

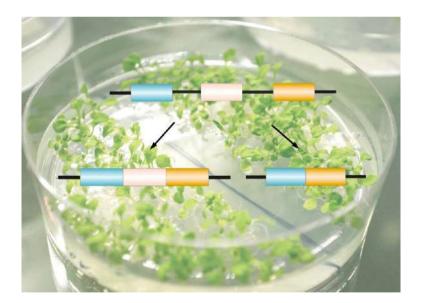


Figure: Alternative splicing is a key posttranscriptional mechanism that generates multiple transcripts from the same gene, thus greatly expanding the coding and regulatory capacities of eukaryotic genomes. This mRNA processing step is known to determine many crucial biological processes in animal systems and to underlie important human diseases, but its physiological relevance in plants remains poorly understood. Compelling evidence for a pivotal role of this mode of posttranscriptional regulation in plant responses to stress has been accumulating.

Telomeres and Genome Stability

Group Leader | FERREIRA, Miguel Godinho

Research Interests

Our main goal is to understand the mechanisms that promote the rise of cancer incidence with age and to understand the role telomeres plays on this phenomenon. Telomeres protect the ends of chromosomes from inappropriately being recognized as a double strand break and constant DNA erosion. Due to telomere shortening, senescent cells accumulate with age. These cells secrete a very distinct set of signalling factors, proteas-

es and other molecules (SASP). SASP promotes both malignant phenotypes in culture and tumor growth and invasiveness *in vivo*. The "seed-and-soil" theory proposes the importance of the microenvironment for carcinogenesis. With aging, senescent cells with short telomeres may provide the right soil for tumors to arise in a non-cell autonomous manner.



Lab Members in 2018

Bruno Bastos · Postdoc Mounir El Mai · Postdoc Kety Giannetti · Postdoc Marta Marzullo · Postdoc

Patrícia Napoleão · Postdoc | Left in May

Jose Planells · Postdoc

Pamela Borges · PhD Student | Started in January,

left in December

Edison Carvalho · PhD Student, 2014 PGCD | Left in December **Kirsten Lex** · PhD Student, 2013 PIBS | Left in December

Mariana Maia Gil · PhD Student | Started in February

Tânia Ferreira · Lab Manager Sónia Rosa · Wing Technician



Our interests span from the role of telomeres inside the cell, by maintaining telomere length and integrity, to outside the cells, by promoting tissue integrity. This year, we found that a novel protein phosphatase, called SSU72, is responsible for terminating the cycle of telomerase elongation. This fundamentally regulated mechanism is conserved from single cell organisms, like fission yeast, to complex

organisms, such as humans. Outside the cell, we found that, as organisms age, telomere shortening alters tissue microenvironment by triggering cell senescence and inflammation. Using the telomerase deficient zebrafish as a premature aging model, we showed that these events increase cancer incidence in an organism systemic manner.

Publications

Macedo, J. C., Vaz, S., Bakker, B., Ribeiro, R., Bakker, P. L., Escandell, J. M., Ferreira, M. G., Medema, R., Foijer, F., & Logarinho, E. (2018). FoxM1 repression during human aging leads to mitotic decline and aneuploidy-driven full senescence. *Nature Communications*, 9(1). https://doi.org/10.1038/s41467-018-05258-6

Funding

> Fundação para a Ciência e a Tecnologia

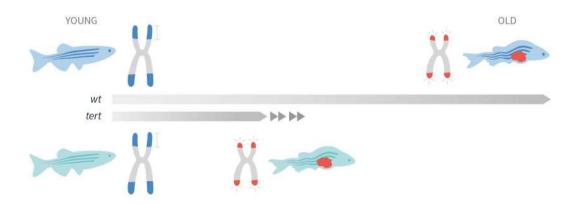


Figure: Telomeres are important protective structures at the tips of chromosomes. Throughout aging, there is a natural shortening of telomeres (wt), but the pace of shortening is much faster in organisms that lack the enzyme telomerase (tert). We discovered that fish mutated for this enzyme age prematurely. Strikingly they also accelerate the onset of cancer in young individuals. Therefore, telomere shortening may be responsible for the higher incidence of cancer during aging.

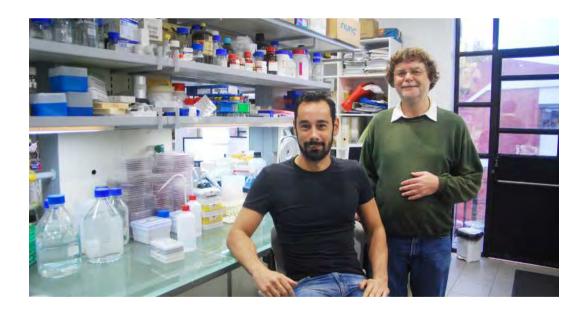
Lupus and Autoreactive Immune Repertoires

Group Leader | FESEL, Constantin

Research Interests

Systemic Lupus Erythematosus (SLE) is a human autoimmune disorder where altered physiologies and self-reactive repertoires of both B- and T-cells are intimately connected. We are particularly interested in the role of T-cell regulation. We have previously found particular relations between antibody reactivity and regulatory T-cells (Tregs) in unaffected relatives of SLE patients, which reflect the upregulation of the IL-2 receptor CD25

on Tregs upon activation that allows relatives to compensate shared CD25 reduction on developmentally early Tregs. In patients with manifest SLE, however, CD25 undergoes little upregulation and remains low. This context has recently gained public interest since low-dose IL-2 therapy, which corrects CD25 deficiency, was found clinically promising for SLE.



Lab Members in 2018

Nuno Costa · PhD student | Left in January



In SLE patients studied longitudinally, deficient Treg CD25 upregulation is connected to an altered dynamic turnover of Treg as well as T-helper cells, disease activity-related longitudinal instability of activated Treg frequencies and lymphopenia-driven temporary clonal T-cell expansions. We have now also studied

genome-wide CD4+ T-cell gene expression in this context, and found indications of a component of the expression profile that reflects the observed dynamic changes. This may help understanding factors that trigger disease flares in SLE.

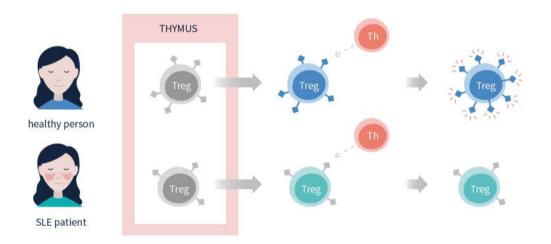


Figure: Systemic Lupus Erythematosus (SLE) is a human autoimmune disease characterized by altered physiologies and immune responses that can affect diverse organs, particularly through tissue damage. T-cells are generated in the thymus and have an important role in the immune response, including the generation of self-reactive antibodies. Some T-cells (Treg) have immunoregulatory functions and specific receptors (CD25) important for them. In SLE patients, there is a heritable deficiency of CD25 receptors in early Tregs, as well as a separate defect in later peripheral upregulation of CD25 that leads to Treg instability. This distinction may help develop Treg-directed therapies.





Mathematical Modelling of Biological Processes

Group Leader | GJINI, Erida

Research Interests

We investigate mechanistic determinants of infection dynamics in a single host and transmission in populations. Considering host-pathogen scenarios under interventions and host microenvironment differences, we study mathematically the interplay of host immune components and mi-

crobial phenotypes in infection resolution, strain competition, drug resistance, and pathogenesis. We are especially interested in uncovering the extent, the causes and consequences of phenotypic diversity in microbes.



Lab Members in 2018

Afonso Dimas Martins · Masters student | Started in January Francisco Paupério · Masters student Patrícia Brito · Visitor | Left in July

Funding

> Fundação Luso-Americana para o Desenvolvimento

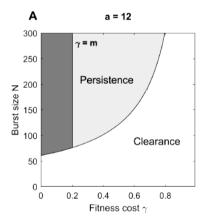


We have studied intracellular infection dynamics in a bacteria-macrophage system, applicable to microbes such as *Salmonella*, *M. tuberculosis* and *E. coli*. Modelling target cell-bacteria interaction, with/without adaptive immunity and antibiotics, we uncovered 3 scenarios mediated by bacterial growth and death processes. Our analysis revealed critical mechanisms for bacterial fitness and transitions from chronic to acute, to containment of infection. We pinpoint key bacterial phenotypes for experimental perturbation and optimal intervention.

We also developed methods for estimating phenotypic diversity in bacteria from *in vitro*

dynamics under antibiotics (e.g. experimental *E.coli* data), and frameworks for estimating relative transmissibility of influenza virus strains from competitive mixture models with explicit in-host competition and frequency-dependence. In a collaboration with the lab of Dr. Luisa Figueiredo at IMM, we investigated host microenvironment differences faced by trypanosome parasites when growing in the blood and adipose tissue. We link data with models to dissect hypotheses for which differences apply, and

why, between these two in-host compartments.



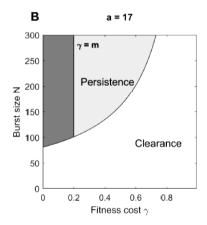


Figure: Quantifying bacterial success with a mathematical model of bacteria-macrophage intracellular infection dynamics (from the Master project of Francisco Paupério). Three final regimes result from biological parameter combinations. The white region represents bacterial clearance, the light-gray region represents persistent coexistence of Sensitive and Resistant bacteria, the dark gray region depicts Resistant-only persistence. A. Infected macrophage apoptosis rate (a=12) is relatively low. B. Infected macrophage apoptosis rate (a=17) is relatively higher. The clearance-persistence boundary is defined, among others, by a critical requirement for sufficiently high burst size of bacteria from infected macrophages: N>(a+d)/d(1- γ), where: a equals the infected macrophage apoptosis rate; d is the burst rate of infected macrophages; γ is the intracellular fitness cost of resistant bacteria. For low fitness cost relative to S \rightarrow R mutation rate (vertical line for illustration), the drug-resistant bacteria take over the population. As infected macrophage apoptosis a increases (compare A to B), bacterial fitness gets weaker, and the region of infection persistence decreases. Different components of host and pathogen heterogeneity intertwine and contribute to infection diversity.

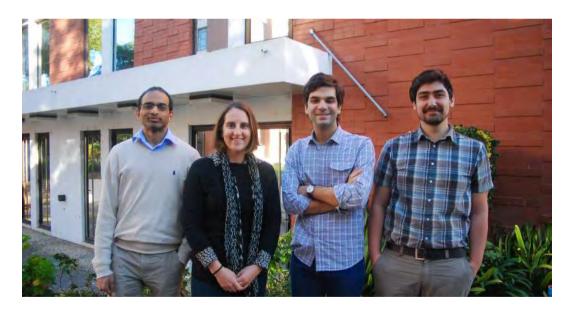
Science & Policy

Group Leader | GONÇALVES-SÁ, Joana

Research Interests

Individuals decide how to vote, whether or not to stay at home when they feel sick. In isolation, these individual decisions have a negligible social outcome, but collectively they determine the results of an election and the start of an epidemic. For many years, studying these processes was limited to observing outcomes or to analysing small samples. New data sources and analysis tools have made it possible to study the behaviour of large numbers of individuals, enabling

the emergence of large-scale quantitative social research. At the S&P group we are interested in understanding these decision-making events, particularly the behaviours that affect health and disease. Thus, we use a systems-level and big data approach to study complex problems at the interface between Biology, Computation, Social Sciences and Mathematics. These include digital epidemiology, risk awareness, critical thinking, and their applications to human-behaviour.



Lab Members in 2018

Carla Semedo · Administrative personnel Cláudio Haupt · Masters student

Lourenço Oliveira · Trainee | Left in February

Paulo Almeida · Technician



The second Citizen Forum (co-organised by Jana Gonçalves-Sá and Paulo Almeida): a panel of randomly selected citizens spent 2 days deliberating on "What conditions should be offered to migrants?", in collaboration with Teatro Maria Matos

The PI and the Science and Policy Group have moved to the NOVA SBE, the School of Business and Economics, at Universidade Nova de Lisboa.

The Science and Policy group received three funding grants for a total of more than 300.000€.

Claudio Haupf-Vieira was awarded an FCT PhD fellowship.

Funding

- > Fundação para a Ciência e a Tecnologia
- > Fundação Calouste Gulbenkian

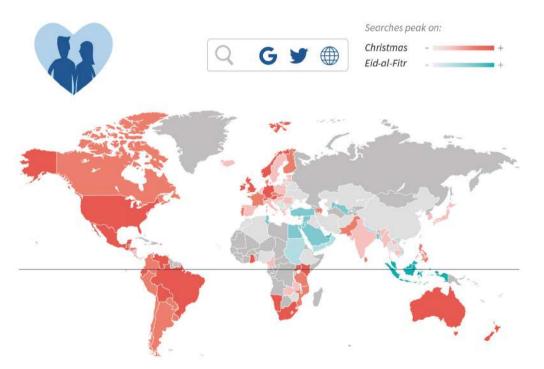


Figure: We discovered that there is a "loving mood", around specific celebrations, and that this mood is associated with an increase in both online and offline sexual interest. By analyzing data from Google Trends, Twitter, and other sources, we found that online searches for sex have a cyclical nature peaking around major cultural festivities (Christmas in Christian countries and Eid-al-Fitr in Muslim countries), regardless of hemisphere location. These also correlate with an increase in births, 9 months later.

Evolutionary Biology

Group Leader | GORDO, Isabel

Research Interests

The evolutionary biology lab combines theoretical and empirical work with the aim at understanding the major evolutionary forces that shape variation in microbial populations. They study the process of bacterial adaptation in ecological relevant environments: in the context of mammalian gut microbiota ecosystem and under specific pressures from the host immune system and certain drugs. They determine the level of epistatic interactions on fitness between mutations that confer antibiotic resistance, and strive to design new strategies for lowering antimicrobial resistance.

These strategies are grounded by basic research on bacterial growth and physiology. They model the evolution of mutation rates and study the factors that influence variation for mutation rate in bacterial populations inhabiting rich ecosystems, namely antibiotics and host inflammation. They are developing modelling frameworks of eco-evolutionary dynamics that can help understanding the genetic structure of the microbiomes of mice and humans and how they can be affected by perturbations, internal – host aging and gut inflammation – and external – antibiotics and specific food supplements.



Lab Members in 2018

Roberto Balbotín · Postdoc Paulo Durão · Postdoc Nelson Frazão · Postdoc

Ozhan Ozkaya · Postdoc | Left in February

Ricardo Ramiro · Postdoc

Dragan Stajic · Postdoc | Started in March

Massimo Amicone · PhD student, 2018 IBB Hugo Barreto · PhD student, 2017 IBB Luís Cardoso · PhD student, 2015 IBB Ana-Hermina Ghenu · PhD student, 2017 IBB

Daniela Güleresi · Lab Manager



During 2018 we published two papers, one authored by a co-supervised PhD student and a postdoc of the lab, on the maintenance of cheating for two cooperative traits in the bacteria Pseudomonas, another a review on the evolutionary mechanisms in the emergence and maintenance of antibiotic resistance. which has been recommended as a must read by Faculty 1000. We also have made substantial progress in determining the fitness effects of mutations, including antibiotic resistances. in the context of the microbiome, and in the experimental and theoretical modelling of evolution and ecology in this ecosystem. We have submitted a manuscript describing how the process of horizontal gene transfer can override the accumulation of adaptive muta-

tions when a new strain colonizes the mouse gut and how the eco-evolutionary dynamics can be driven by competition for resources and driven by phages. We are preparing a manuscript where the emergence and maintenance of clones with increased mutation rates within a commensal lineage colonizing the gut is described and modelling work that allows estimating the fitness effects of both beneficial and deleterious mutations in this ecosystem. We have started a new project on yeast, in collaboration with the group of Lília Perfeito, with the aim of understanding how the temporal dynamics of adaption depend on the starting genotype and if populations reach similar fitness peaks across different environments.

Publications

- Özkaya, Ö., Balbontín, R., Gordo, I., & Xavier, K. B. (2018). Cheating on Cheaters Stabilizes Cooperation in *Pseudomonas aeruginosa. Current Biology*, 28(13), 2070–2080.e6. https://doi.org/10.1016/j. cub.2018.04.093
- Durão, P., Balbontín, R., & Gordo, I. (2018). Evolutionary Mechanisms Shaping the Maintenance of Antibiotic Resistance. *Trends in Microbiology*, 26(8), 677–691. https://doi.org/10.1016/j.tim.2018.01.005
- Gordo, I. Evolutionary change in the human gut microbiome: from a static to a dynamic view. PLOS Biology (accepted)

Funding

- > Fundação para a Ciência e a Tecnologia (FCT)
- University of Cologne/ German Research Foundation (DFG)
- JPI AMR
- > Fundos Europeus Estruturais e de Investimento (FEEI), Programa Operacional Regional Lisboa 2020 and FCT



Figure: Antibiotic-resistant bacteria have mutations that most often are prejudicial in the absence of the drug. To overcome this, bacteria need to acquire additional compensatory mutations. We identified the key proteins involved in the compensatory mechanism of multi-drug resistant bacteria (green), a feature that might be used in the future as a new therapeutic target.

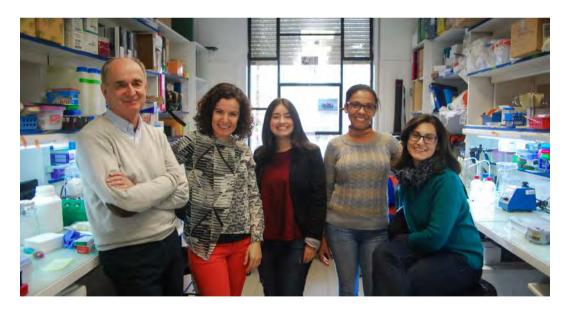
Host-Pathogen Co-Evolution

Group Leader | HOWARD, Jonathan C.

Research Interests

Our work focuses on mechanisms of resistance to the ubiquitous intracellular protozoan parasite, *Toxoplasma gondii*, a malaria relative, which infects about 40% of the human race. We study immunity of mice against *T. gondii* because the primary hosts of the parasite, in which it makes gametes and does meiosis, is cats, so the *T. gondii* life cycle, and its abundance in our environment, is thus driven by an infectious cycle between cat and mouse. Mouse immunity against *T. gondii* is

based on a mechanism absent in humans, inducible GTPases (IRG proteins) that cooperatively destroy the vacuole in which the parasite lives. This mechanism has in turn been targeted by the parasite, via a family of kinases that inactivate IRG proteins. Both the IRG proteins and the kinases are massively polymorphic, consistent with a complex co-evolutionary dynamic. Our work stretches from ecological studies on wild mice to cell biological, biochemical and structural studies.



Lab Members in 2018

Joana Loureiro · Postdoc

Martha Meneses · PhD student, 2015 IBB Ana Rodrigues · PhD student, 2015 PGCD Cláudia Campos · Lab manager Camille Lunen · Visitor

Funding

> Fundação Calouste Gulbenkian



Thanks to the skill of the Animal House Facility, we were able for the first time to create a frozen bank of embryos from a wild-derived mouse strain from S. India and another from Peru.

Thanks to the skill of the Transgenics Facility we were able to regenerate from a new ES cell clone a targeted mutant mouse strain deficient in the IRGC gene. The original mutant strain was lost in a freezer meltdown in Germany. The IRGC gene encodes a protein that is extremely well-conserved throughout the mammals and expressed exclusively in haploid spermatids.

The development of quantitative assays for acute necrosis induced in infected cells from mouse strains resistant to *T. gondii* has made analysis of the resistance mechanism possible *in vitro*, functionally replacing whole animal infection experiments.

An active collaboration with a group in Freiburg, Germany, has successfully identified the main resistance molecule responsible for the resistance of certain mouse genotypes against hypervirulent *T. gondii* strains (in revision).

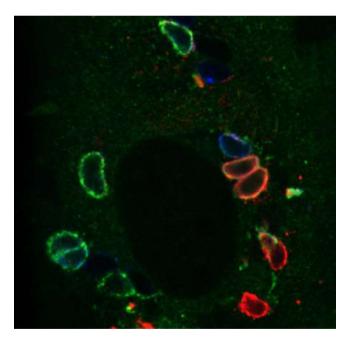


Figure: Confocal image of Immortalized Mouse Embryonic Fibroblasts infected with *Toxoplasma gondii* and stainned for Dense granules proteín (GRA7) and immunity-related GTPases (IRGs).

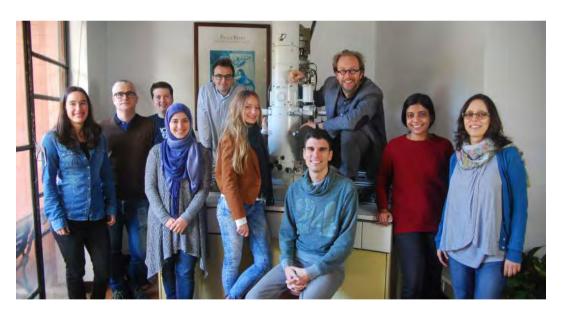
Epigenetic Mechanisms

Group Leader | JANSEN, Lars E.T.

Research Interests

The genome is propagated through cell division cycles by the faithful duplication and segregation of chromosomes into two new daughter cells during mitotic divisions. In addition, so-called "epigenetic" chromosome structures that maintain functional chromosomes and that "memorize" the transcriptional state of a cell lineage are also maintained through mitotic and sometimes even

meiotic divisions. How the more fluid epigenetic information of gene activities and chromosome structure is maintained in time is not understood. We are interested in resolving the mechanisms, dynamics and evolutionally impact of epigenetic memory.



Lab Members in 2018

Inês Milagre · Postdoc Sreyoshi Mitra · Postdoc Marina Pineda · Postdoc Wojciech Siwek · Postdoc

Dragan Stajic · Postdoc | Left in March

Ana Stankovic · PhD student, 2012 PIBS | Left in January Sebastiaan Van Den Berg · PhD student, 2017 IBB

Sahar Tehrani · PhD student, 2017 IBB

João Mata · Technician

Mariana Fernandes · Technician | Started in January

Funding

> European Research Council



We have developed new methodologies to determine histone variant dynamics in human cells genome-wide in order to discover how chromatin contributes to epigenetic memory. This new methodology was published in *Methods in Molecular Biology* in 2018.

Further, we completed an interdisciplinary and intra-IGC collaborative effort with the group of Lília Perfeito to test an emerging question in evolution: Can epigenetically heritable gene expression affect the evolutionary adaption of a population? We discovered that low levels of heritable silencing drive populations to evolve faster by acquisition of novel alleles that enhance gene silencing, aiding accelerated adaptation. This study defines the impact and mechanisms of how short-term epigenetic inheritance can shape adaptive evolution, work that is now in press at *Nature Ecology and Evolution*.

Publications

- Siwek, W., Gómez-Rodríguez, M., Sobral, D., Corrêa, I. R., & Jansen, L. E. T. (2018). time-ChIP: A Method to Determine Long-Term Locus-Specific Nucleosome Inheritance. In G. A. Orsi & G. Almouzni (Eds.), *Histone Variants* (Vol. 1832, pp. 131–158). New York, NY: Springer New York. https://doi.org/10.1007/978-1-4939-8663-7
- > Stajic, D., Perfeito, L. and Jansen, L. E. T. Epigenetic gene silencing alters the mechanisms and rate of evolutionary adaptation. *Nature Ecol Evol*. (in press)

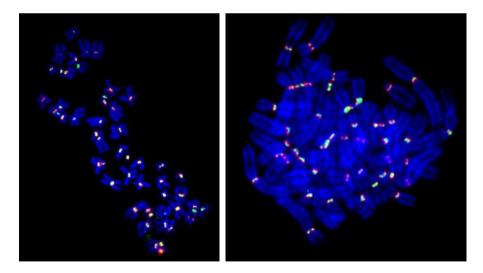


Figure: Images show mitotic human chromosomes in which the centromere is labeled by green and red centromere-specific proteins. Centromeres are chromosomal loci that are epigenetically inherited through cell division.

Patterning and Morphogenesis

Group Leader | MALLO, Moisés

Research Interests

The ultimate goal of our research group is to understand how patterning information is translated in morphogenetic processes during vertebrate embryonic development. One of our main current focuses aims at determining what regulates the function of the axial progenitors that make the different body elements, and the role they play in

the evolution of the vertebrate body plan. Most of our work uses the mouse as the model system by means of *in vivo* genetic analysis complemented with *in vitro* differentiation systems involving stem and progenitor cells. We have recently incorporated other model systems to address Evo-Devo questions derived from our research.



Lab Members in 2018

Ana Rita Aires · Postdoc | Left in November Luísa Machado · Postdoc | Left in September

André Dias · PhD student, 2017 IBB

Patrícia Duarte · PhD student, 2018 IBB | Started in March

Anastasiia Lozovska · PhD student, 2017 IBB Irma Varela Lasheras · PhD student, 2011 PIBS

Ana Casaca · Laboratory Manager

Kyriel Pineault · Visitor | Started in September

Funding

> Fundação para a Ciência e a Tecnologia



The work performed during this year has shown that the axial progenitors that build the postsacral body of vertebrates, despite deriving directly from their trunk counterparts, are regulated by a totally different genetic network. In particular, while trunk progenitors depend on Oct4, tail progenitors are under the control of a network involving Gdf11, Lin28 and Hox13 genes. We have also shown that this regulatory switch involves an epithelial to

mesenchymal transition (EMT) that requires the activity of the Snail gene. Importantly, this EMT differs from the one generating mesodermal tissues from the same cells during gastrulation in that it keeps the cells in a progenitor state able to further extend the main body axis. These results might also provide the grounds to understand tail length diversity among vertebrates.

Selected Publications*

- Mallo, M. (2018). Reassessing the Role of Hox Genes during Vertebrate Development and Evolution. *Trends in Genetics*, 34(3), 209–217. https://doi. org/10.1016/j.tig.2017.11.007
- Aires, R., Dias, A., & Mallo, M. (2018). Deconstructing the molecular mechanisms shaping the vertebrate body plan. *Current Opinion in Cell Biology*, 55, 81–86. https://doi.org/10.1016/j.ceb.2018.05.009
- Aires, R., de Lemos, L., Nóvoa, A., Jurberg, A. A., Mascrez, B., Duboule, D., & Mallo, M. Tail Bud Progenitor Activity Relies on a Network Comprising Gdf11, Lin28, and Hox13 Genes. *Developmental Cell.* https://doi.org/10.1016/j.devcel.2018.12.004 (*in press*)
 - * The complete list of publications is available on section 3. Publications.

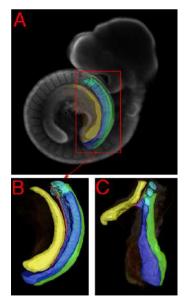


Figure: Mouse embryos have a well-organized tail bud at their posterior end (A, B), which is malformed in embryos mutant for the Snai1 gene (C).





Lymphocyte Development and Leukemogenesis

Group Leader | MARTINS, Vera

Research Interests

Research in the lab focuses on T lymphocyte development, both in the steady state and in conditions that are permissive to the development of leukemia. T lymphocyte development occurs mostly in the thymus from progenitors of bone marrow origin in a process that involves high cellular turnover. We found that turnover is partly regulated by cell competition. Specifically, 'young' hematopoietic precursors, with a short dwell time in the thymus, led to the clearance of the 'old' precursors, residing for longer in the thymus. Of note, cell competition is not cell autonomous, i.e., it is the presence of the young that induces

the clearance of the old precursors. Consistently, when no progenitors seed the thymus, i.e., if no cell competition takes place, old precursors persist in the thymus and autonomously maintain thymopoiesis. While this function might be beneficial in particular conditions of progenitor shortage, prolonging autonomy enables the emergence of T cell acute lymphoblastic leukemia. The lab focuses on the identification and characterization of the cellular and molecular mechanisms governing cell competition in normal thymus turnover, and on the changes occurring during thymus autonomy and then leukemia.



Lab Members in 2018

Luna Ballesteros · Postdoc | Left in March Rafael Paiva · PhD student, 2016 IBB Camila Ramos · PhD student, 2017 IBB Mariana Ávila · MSc student | Started in February,

left in November

Carolina Alves · Lab manager | Left in April

Vasco Correia · Technician

Ana Teresa Pais · Summer student | Started in June,

left in September



Camila Ramos, PhD student, won the **prize** for the best poster at the PhD retreat organized by AMeeGuS.

Rafael Paiva, PhD student, won the **best poster award** at the Annual meeting of the Portuguese Society of Immunology.

Vera Martins, PI, became member of the Board of Directors (Scientific Secretary) of the Portuguese Society of Immunology (SPI) on the 06/2018

Mariana Ávila, MSc student, defended her MSc thesis. This was the first **MSc thesis** from the lab.

Camila Ramos, Rafael Paiva and Vera Martins wrote a **viewpoint article** for the *FEBS Journal*.

We have the **first peer-reviewed article** from the lab accepted at *The Journal of Immunology*.

We've got a **Project grant from FCT**, which was the first grant for the lab.

Publications

- Paiva, R. A., Ramos, C. V., & Martins, V. C. (2018). Thymus autonomy as a prelude to leukemia. *The FEBS Journal*, 285(24), 4565–4574. https://doi.org/10.1111/febs.14651
- Ballesteros-Arias, L.*, Silva, J.G.*, Paiva, R.A., Carbonetto, B., Faísca, P., and Martins, V.C.. T cell acute lymphoblastic leukemia as a consequence of thymus autonomy. J. Immunol. (accepted)

Funding

> Fundação para a Ciência e a Tecnologia

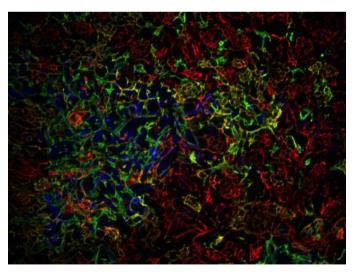


Figure: Thymic architecture. Immunohistochemistry analysis of a wild type thymus section stained for keratin 5 (green), keratin 8 (red) and CD11c (blue). Image acquired in Leica DMRA2 microscope using a 20x magnification.

Innate Immunity and Inflammation

Group Leader | MOITA, Luís Ferreira

Research Interests

Severe sepsis remains a poorly understood systemic inflammatory condition with high mortality rates and limited therapeutic options outside of infection control and organ support measures. Based on our recent discovery in mice showing that anthracycline drugs prevent organ failure without affecting the bacterial burden in a model of severe sepsis, we propose that strategies aimed at target organ protection have extraordinary potential for the treatment of sepsis and possibly for

other inflammation-driven conditions. However, the mechanisms of organ protection and disease tolerance are either unknown or poorly characterized. The central goal of this research program is to identify and characterize novel cytoprotective mechanisms, with a focus on DNA damage response dependent protection activated by anthracyclines as a window into stress-induced genetic programmes leading to tissue protection.



Lab Members in 2018

Ana Costa · Postdoc

Philipp Seidel · Postdoc | Left in July Katharina Willmann · Postdoc

André Barros · PhD student

Henrique Colaço · PhD student, 2015 IBB

Isa Santos · PhD student

Tiago Velho · PhD student

Elsa Seixas · Laboratory Manager | Started in February

Dora Pedroso · Technician

Susana Moreira · Visitor | Left in January

Catarina Moita · Visitor



- 1. Identified novel clinical approved drugs that can be used to induce Disease Tolerance;
- 2. Discovered an olfactory receptor, expressed and induced in the lung upon infection;
- 3. Identified a role for GDF15 in sepsis

Publication

Staats, R., Rodrigues, R., Barros, A., Bacelar-Nicolau, L., Aguiar, M., Fernandes, D., Moreira, S., Simões, A., Silva-Santos, B., Rodrigues, J. V., Barbara, C., de Almeida, A. B., **Moita, L. F.** (2018) Decrease of perforin positive CD3+ $\gamma\delta$ -T cells in patients with obstructive sleep disordered breathing. *Sleep Breath.* 2018 Mar;22(1):211-221. doi: 10.1007/s11325-017-1602-6

Funding

- > European Research Council
- > Fundação para a Ciência e a Tecnologia

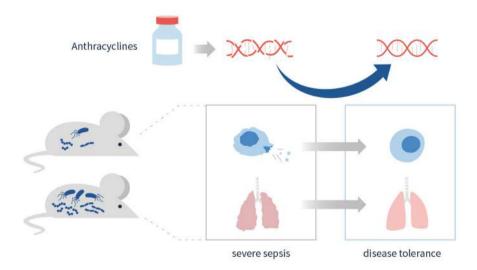


Figure: Severe sepsis is a life-threatening condition where there is a deregulated systemic inflammatory response to an infection, and for which there are limited therapeutic options. As a defence strategy, the organism relies on tissue damage control mechanisms that prevent the deleterious effects of pathogens, a process known as disease tolerance. We used the mouse model to show that some drugs, like anthracyclines, confer protection against sepsis by increasing disease tolerance to infection, limiting disease severity irrespectively of pathogen load. However, this salutary effect is dependent on the activation of DNA damage response and cell destruction pathways in the lung.

Chromosome Dynamics

Group Leader | OLIVEIRA, Raquel A.

Research Interests

We study how chromosome architecture contributes to faithful genome segregation. Genome stability relies on the fact that at each round of cell division, the genetic information encoded in the DNA molecules is properly segregated into the two daughter cells. Our laboratory adopts a multidisciplinary approach to evaluate how dynamic mitotic chromosomes are assembled and how their morphology influences the mechanical aspects of chromosome movement and cell cycle

checkpoint signalling. In parallel, we aim to dissect how different cells respond to compromised chromosome cohesion and condensation, both at the cellular and organism level. By studying the contribution of chromosome structure in the mechanics of nuclear division we aim to identify novel routes to aneuploidy that underlie several human conditions, including developmental diseases, cancer and infertility.



Lab Members in 2018

Sara Carvalhal · Postdoc

João Coelho · Postdoc | Started in November

Leonardo Guilgur · Postdoc

Inês Milagre · Postdoc | Started in September Margarida Araújo · PhD student, 2017 IBB Catarina Carmo · PhD student, 2017 IBB

Mihailo Mirkovic · PhD student, 2014 IBB | Left in September

Cíntia Ramos · PhD student, 2014 PGCD **Mário Soares** · PhD student, 2015 IBB **Alexandra Tavares** · Lab manager



Our work indicates that mild cohesin decay compromises mitotic fidelity by a novel mechanism (impairing chromosome attachments) (Carvalhal et al, 2018). This leads to relatively mild mitotic defects, as opposed to full cohesion defects that induce severe aneuploidy. Although mild, these can be significant in terms of genome stability. Another work from our lab

also in *Drosophila melanogaster* demonstrated that the spindle assembly checkpoint which normally works as a safeguard mechanism for mitotic fidelity, aggravates the chromosome segregation defects associated with premature loss of sister chromatid cohesion during mitosis (Silva et al. 2018).

Publications

- Carvalhal, S., Tavares, A., Santos, M. B., Mirkovic, M., & Oliveira, R. A. (2018). A quantitative analysis of cohesin decay in mitotic fidelity. *The Journal of Cell Biology*, 217(10), 3343–3353. https://doi.org/10.1083/ jcb.201801111
- Silva, R. D., Mirkovic, M., Guilgur, L. G., Rathore, O. S., Martinho, R. G., & Oliveira, R. A. (2018). Absence of the Spindle Assembly Checkpoint Restores Mitot-
- ic Fidelity upon Loss of Sister Chromatid Cohesion. *Current Biology*, 28(17), 2837–2844.e3. https://doi.org/10.1016/j.cub.2018.06.062
- Mirkovic, M., Guilgur, L. G., Passagem-Santos, D., & Oliveira, R. A. (2018). Delayed aneuploidy stress response of neural stem cells impairs adult lifespan in flies. *BioRxiv*. https://doi.org/10.1101/392746

Funding

- > European Research Council
- > European Molecular Biology Organization
- > Fundação para a Ciência e a Tecnologia

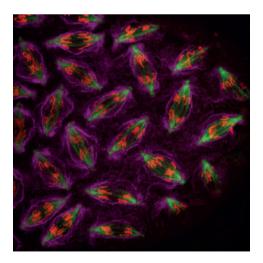


Figure: *Drosophila* embryos: Chromosome separation. Still images from a time lapse (live imaging) from a *Drosophila* syncytial embryo. Artificial separation of sister chromatids by TEV protease-mediated cleavage of cohesin (glue that holds sister chromatids together up to anaphase).

Integrative Behavioural Biology

Group Leader | OLIVEIRA, Rui F.

Research Interests

Our main research interest is the integrative study of social behaviour, which combines the study of proximate causes (gene modules, hormones, neural circuits, cognitive processes) and ultimate effects (evolutionary consequences). In particular we aim to understand how brain and behaviour can be shaped by social environment, and how the cognitive, neural and genetic mechanisms underlying plasticity in the expression of

social behaviour have evolved. For this purpose we use zebrafish and other selected fish species as study models. Current research questions centre on four topics: 1. Evolution of social cognition and of its neuromolecular mechanisms; 2. Genomic and epigenomic mechanisms of social plasticity; 3. Neuroendocrinology of social interactions; 4. Cognitive bias and susceptibility/resilience to disease.



Lab Members in 2018

Felipe Espigares · Postdoc Ana Rita Nunes · Postdoc Magda Teles · Postdoc Susana Varela · Postdoc

Ibukun Akinrinade · PhD student, 2015 IBB **Cláudia Gonçalves** · PhD student, 2017 PGCD

Carla Henriques · PhD student, 2018 IBB | Started in Sept Renato Sousa · PhD student, 2017 IBB | Started in February Sara Cardoso · External PhD student | Left in December

Júlia Pinho · External PhD student Ana Sofia Félix · External PhD student **Leonor Carreira,** • Masters student | Left in March **Miguel Correia** • Masters student | Started in September

Benedita Cyrne · Masters student

Joana Marcos · Masters student | Started in September

Daniela Santos · Masters student | Left in March
Diogo Ribeiro · Volunteer | Left in March

Diana Abad · Visiting PhD student | Left in March

Manuela Brandão · Visiting PhD student | Started in December Etienne Lein · Visiting PhD student | September – October Manuel Sapage · Visiting PhD student | July – September María Florencia Scaia · Visiting Postdoc | Sept – December Zegni Tikki · Visiting PhD student | September – October



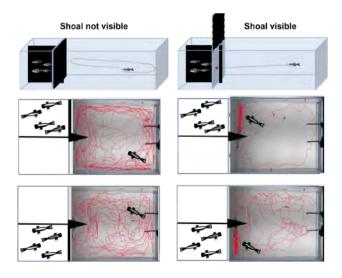
In 2018 the Oliveira lab continued the work on the role of oxytocin in social cognition in zebrafish, as well as work on the role of the social environment on the development and evolution of social cognition and behaviour. Main findings this last year include: (1) the characterization of the molecular mechanisms through which oxytocin neurons regulate sociality in adult zebrafish; (2) identifying the role of cognitive biases (i.e. being optimist vs. pessimist as a key factor in telomere shortening and stress resilience; and (3) showing the effects of early social environment on adult social behaviour. During this year 4 new FCT grants were started, 3 papers were published in peer-reviewed journals, and 1 MSc thesis was completed.

Selected Publications*

- Cardoso, S. D., Gonçalves, D., Goesmann, A., Canário, A. V. M., & Oliveira, R. F. (2018). Temporal variation in brain transcriptome is associated with the expression of female mimicry as a sequential male alternative reproductive tactic in fish. *Molecular Ecology*, 27(3), 789–803. https://doi.org/10.1111/mec.14408
- Costa, R. M., Oliveira, G., Pestana, J., Costa, D., & Oliveira, R. F. (2018). Do psychosocial factors moderate the relation between testosterone and female sexual desire? The role of interoception, alexithymia, de-

fense mechanisms, and relationship status. *Adaptive Human Behavior and Physiology* 1-18. https://doi.org/10.1007/s40750-018-0102-7

- Pestana J., Menéres S., Gouveia M. J., & Oliveira R. F. (2018). The reading the mind in the eyes test: a portuguese version of the adults' test. *Análise Psicológica*, 3(XXXVI), 369-381. Retrieved from http://hdl.handle.net/10400.12/6718
 - * The complete list of publications is available on section 3. Publications.



Funding

- Fundação para a Ciência e a Tecnologia
- Rial
- Fundo Europeu de Desenvolvimento Regional (FEDER)
- > European Regional Development Fund (ERDF), European Commission

Figure: Adult zebrafish express a preference to associate with other conspecifics as measured by videotracking. Early ablation of oxytocin neurons impairs this social preference suggesting a role of these neurons in zebrafish sociality.

Infections & Immunity

Group Leader | PARKHOUSE, Michael

Research Interests

- Pathogen modulation of host cell biology and innate immunity;
- > Control of neurocysticercosis.



Lab Members in 2018

Sílvia Correia · Postdoc Rute Nascimento · Postdoc Ana Ferreira · Masters student

Inês Moreira · Masters student | Started in September

Diogo Tomaz · Technician | Left in October **Joana Almeida** · Trainee | Started in September

Funding

> Fundação para a Ciência e a Tecnologia



Work continues on defining the mechanisms of 3 African Swine Fever (ASFV) genes that inhibit the interferon response. In addition, an ASFV gene inhibiting cytokine responses has been identified.

The ASFVs non-essential, non-homologous, gene I329L which inhibits Toll-like receptor activation through two mechanisms, has been deleted from the virus and is being tested as a vaccine

The non-homologous HCMV gene UL76 induces cell cycle arrest via its conserved N-terminal domain and induces expression of IL-8 via its variable C-terminal domain.

A lateral flow assay has been developed for the rapid detection of human extraparenchymal neurocysticercosis in serum and cerebrospinal fluid, and has been used for diagnosis in Mexico and Ecuador.

Selected Publications*

- Parkhouse, R. M. E., Carpio, A., Campoverde, A., Sastre, P., Rojas, G., Harrison, L. J. S., & Cortez, M. M. (2018). A modified lateral flow assay, using serum, for the rapid identification of human and bovine cysticercosis in the absence of false positives. *Transactions of The Royal Society of Tropical Medicine and Hygiene*. https://doi.org/10.1093/trstmh/try116
- Parkhouse, R. M. E., Carpio, A., Campoverde, A., Sastre, P., Rojas, G., & Cortez, M. M. (2018). Reciprocal contribution of clinical studies and the HP10 antigen ELISA for the diagnosis of extraparenchymal neurocysticercosis. *Acta Tropica*, 178, 119–123. https://doi.org/10.1016/j.actatropica.2017.11.005
- Sánchez-Hernández, L., Montero, L., Mojica-Espinosa, R., Reyes-Grajeda, J. P., Cervantes-Torres, J., Parkhouse, R. M., Fragoso, G., & Sciutto, E. (2018). Impact of the GK-1 adjuvant on peritoneal macrophages gene expression and phagocytosis. *Immunology Letters*, 201, 20–30. https://doi.org/10.1016/j.imlet.2018.10.010
 - * The complete list of publications is available on section 3. Publications.

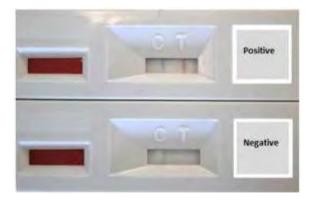


Figure: The HP10 lateral flow assay. Example of a positive (red band) HP10 Ag-LFA. The blue band is the negative control.

Disease Genetics

Group Leader | PENHA GONÇALVES, Carlos

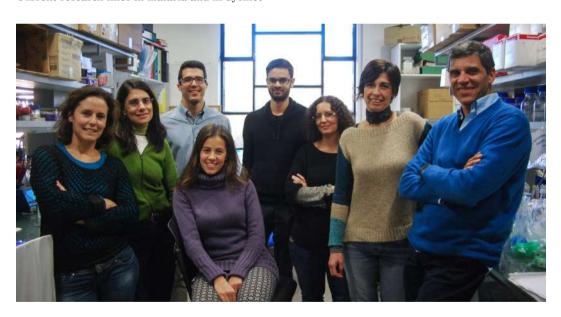
Research Interests

Responses of organ-specific cell-types to contextual cues (infectious or metabolic) are drivers of inflammatory trajectories and clinical outcomes of disease. We are centering our research in understanding how cell-type specific phenotypic adaptation to pro-inflammatory and infectious environments impacts in tissue recovery and in preservation of organ and systemic functions.

Current research lines in malaria and in dysmet-

abolic conditions are focused in the action of macrophages trophoblasts and endothelial cells to discern mechanisms of disease adaptation at tissue/organ level.

One particular interest is to know if organ-specific cell-types after exposure to damage restrain organ/systemic responses in subsequent injury or chronic disease challenges.



Lab Members in 2018

Luciana Moraes · Postdoc | Left in August

Rita Neres · Postdoc | Left in May

Teresa Pais · Postdoc

Inês Coelho · PhD student, 2015 IBB Yash Pandya · PhD student, 2015 IBB

Abdul Muktadir Shafi · PhD student, 2018 IBB

Hajrabibi Ali · Masters student | Started in October

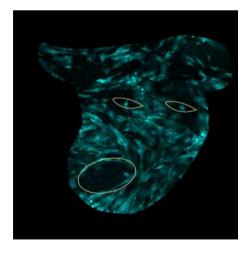
Nádia Duarte · Lab manager Alexander Marta · Trainee Rita Patarrão · Visitor Diego Borges · Visitor



- Interferon-beta is induced in brain microvessel endothelial cells during *Plasmodium* infection and is critical for development of cerebral malaria.
- > TLR4 expression in placental trophoblast takes part in the fetal protective response to *Plasmodium*-infected erythrocytes and controls the endothelin pathway and cell migration.
- Mouse trophoblasts display collective motion that is inhibited by *Plasmodium*-infected erythrocytes.
- Loss and recovery of Kupffer cells during severe liver injury is mirrored by CD26/DPP4 serum activity.
- > TREM-2 ablation revealed a population of liver damage associated macrophages exhibiting a distinct pro-recovery functional profile.

Selected Publications*

- de Moraes, L. V., Barateiro, A., Sousa, P. M., & **Penha-Gonçalves**, **C.** (2018). Bradykinin Sequestration by Plasmodium berghei Infected Erythrocytes Conditions B2R Signaling and Parasite Uptake by Fetal Trophoblasts. *Frontiers in Microbiology*, 9. https://doi.org/10.3389/fmicb.2018.03106
- Duarte, N., Coelho, I., Holovanchuk, D., Inês Almeida,
 J., Penha-Gonçalves, C., & Paula Macedo, M. (2018).
 Dipeptidyl Peptidase-4 Is a Pro-Recovery Mediator
 During Acute Hepatotoxic Damage and Mirrors Severe Shifts in Kupffer Cells. Hepatology Communi-
- cations, 2(9), 1080–1094. https://doi.org/10.1002/ hep4.1225
- Rodrigues-Duarte, L., Pandya, Y., Neres, R., & Penha-Gonçalves, C. (2018). Fetal and Maternal Innate Immunity Receptors Have Opposing Effects on the Severity of Experimental Malaria in Pregnancy: Beneficial Roles for Fetus-Derived Toll-Like Receptor 4 and Type I Interferon Receptor 1. Infection and Immunity, 86(5). https://doi.org/10.1128/IAI.00708-17
 - * The complete list of publications is available on section 3. Publications.



Funding

- > ERA Learn | European Commission
- March of Dimes
- > Fundação para a Ciência e a Tecnologia
- European Foundation for the Study of Diabetes/ JDRF/Lilly

Figure: Placental cells "making a face" to the malaria parasite: Cropped image selected from a live time-lapse recording of Cyanfluorescent mouse primary trophoblasts incubated with the *Plasmodium*-infected erythrocytes, that we use to study protective responses against pregnancy malaria.





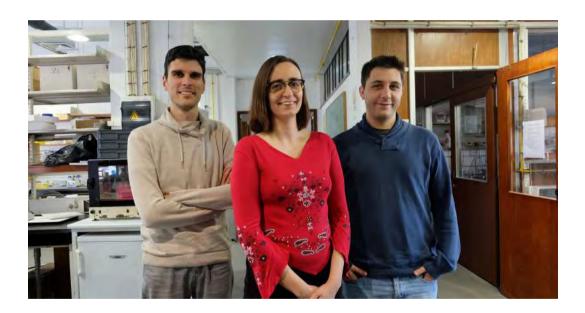
Evolution and Genome Structure

Group Leader | PERFEITO, Lília

Research Interests

Can we predict evolution? This is one of the most fundamental questions in biology today. If we can predict evolution, we can control it. Doing so will change the way we understand biology, the way we use living organisms in biotechnology, the way we treat disease and the way we see ourselves.

Our lab aims to create a predictive framework of evolutionary biology by addressing how variations in genetic background in general, and chromosome structure in particular affect the evolutionary path of populations.



Lab Members in 2018

Diogo Santos · PhD student, 2014 IBB | Left in December

Funding

> Fundação para a Ciência e a Tecnologia



During the year of 2018, we demonstrated that a simple fitness landscape shaped like a power-law was able to make prediction about the adaptation of microorganisms to the lab (*Heredity* 121 (5), 482). This was part of the PhD thesis of Diogo Santos who successfully obtained his degree in early December.

We also wrapped up our collaboration with the Epilab (Lars Jensen) through the acceptance of a manuscript in *Nature Ecology and Evolution* and the successful PhD defense by Dragan Stajic in March. In that paper we demonstrated how the presence epigenetic control of expression can affect both the rate and the types of adaptive mutations.

We also finished a bookchapter on cancer as an evolutionary process to appear soon in a Springer textbook aimed at university students.

Publications

- Stajic, D., Perfeito, L., Jansen, E. T. Epigenetic gene silencing alters the mechanisms and rate of evolutionary adaptation. Nature Ecology and Evolution (in press)
- Perfeito, L. Cancer as an evolutionary process. In Molecular and cell biology of cancer — when cells break
- the rules and highjack their own planet (1st ed.). Springer International Publishing. (in press)
- Passagem-Santos, D., Zacarias, S., & **Perfeito, L.** (2018). Power law fitness landscapes and their ability to predict fitness. *Heredity*, 121(5), 482–498. https://doi.org/10.1038/s41437-018-0143-5

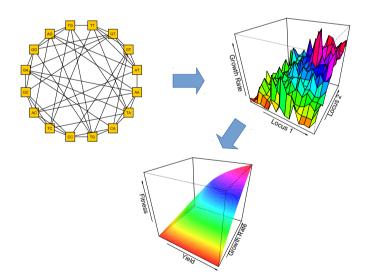


Figure: Illustration of our methodology to build a predictive evolutionary model by going from the complex genotype to a smooth fitness landscape. The top left panel represents the network of all possible genotypes with two *loci*. Each box represents a genotype and edges represent all the possible mutations. The top right panel represents an hypothetical genotype to phenotype landscape, while the bottom panel displays a potential phenotype to fitness landscape.

Complex Adaptive Systems and Computational Biology

Group Leader | ROCHA, Luís M.

Research Interests

The group focuses on tackling multi-level complexity involved in human health, with projects organised in three main threads: complex networks & systems, computational & systems biology, and computational intelligence. Ongoing research ranges from biomedical literature and social media mining to understanding redundan-

cy, robustness, modularity and control in complex networks, collective intelligence on the web and in social systems, and agent-based models of evolutionary systems such as RNA editing and artificial immune systems. We are also committed to interdisciplinary research, teaching and graduate training.



Lab Members in 2018

Rion Correia · External PhD student
Thomas Parmer · External PhD student

Funding

- > Fudação Luso-Americana para o Desenvolvimento
- > National Science Foundation
- National Institutes of Health
- > Indiana University Precision Health Initiative

Software Development

- CANA: A Python Package for Quantifying Control and Canalization in Boolean Networks - https://github. com/rionbr/CANA
- > SyMPToM (Social Media Public Health Monitoring): http://symptom.soic.indiana.edu/
- https://github.com/rionbr/distanceclosure Retrieved from https://www.informatics.indiana.edu/ rocha/publications/SM/



Main Achievements

In terms of research outputs, we are particularly happy with being awarded a new NIH R01 grant and participate in two funded FCT projects with IGC scientists: Joana Sá and Paulo Navarro Costa. We have also produced two main software packages (with associated publications) that were shared with the systems biology and complex networks communities. The PI received many invitations to

speak as keynote in conferences and seminars, such as Network Medicine 2018 (part of NetSci 2018), the Complexity Sciences Week at the Universidad Nacional Autonoma de Mexico, a lecture series at the Universidad Nacional der Sur in Argentina, and many other university and institute colloquia. The PI was also the program chair of Complex Networks 2018.

Selected Publications

- Correia, R. B., Gates, A. J., Wang, X., & Rocha, L. M. (2018). CANA: A Python Package for Quantifying Control and Canalization in Boolean Networks. Frontiers in Physiology, 9. https://doi.org/10.3389/ fphys.2018.01046
- Correia, R. B., de Araújo, L. P., Mattos, M. M., & Rocha, L. M. (2018). City-wide Analysis of Electronic Health Records Reveals Gender and Age Biases in the Administration of Known Drug-Drug Interaction.
- tions. ArXiv:1803.03571 [Cs, q-Bio, Stat]. Retrieved from http://arxiv.org/abs/1803.03571
- Correia, R. B., Ratkiewicz, N., Barrat, A. and Rocha, L.M. (2018). The Metric Backbone of Contact Networks in Epidemic Spread Models. Paper and Materials presented at NetSci 2018: International School and Conference on Network Science. Retrieved from https://www.informatics.indiana.edu/rocha/ publications/SM/

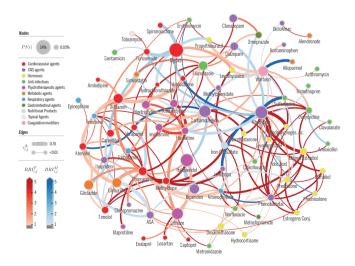


Figure: Drug-Drug Interaction Network obtained from the Electronic Health Records of close to 133 thousand patients of the public health system in Blumenau, Brazil. Node color represents the highest level of primary action class, as retrieved from Drugs.com. Node size represents the probability of interaction (more dangerous drugs larger). Edge weights proportional to co-occurrence of drug prescriptions in time. Edge colors denote risk of interaction per gender: females in blue and males in red, with colour intensity denoting higher risk for respective gender. From: Correia, R. B., de Araújo, L. P., Mattos, M. M., & Rocha, L. M. (2018). City-wide Analysis of Electronic Health Records Reveals Gender and Age Biases in the Administration of Known Drug-Drug Interactions. ArXiv:1803.03571 [Cs, q-Bio, Stat]. Retrieved from http://arxiv.org/abs/1803.03571 (under review in Nature Communications).

Inflammation

Group Leader | SOARES, Miguel P.

Research Interests

To understand the biology of inflammation and immunity as it pertains to the maintenance of homeostasis. To identify and develop therapeutic strategies with an impact on human diseases associated with major morbidity and/or mortality.



Lab Members in 2018

Patricia Amador · Postdoc Faouzi Braza · Postdoc Ana Rita Carlos · Postdoc Rui Martins · Postdoc Susana Ramos · Postdoc Jessica Thompson · Postdoc

 $\textbf{Temitope Ademolue} \cdot \texttt{PhD student, 2018 IBB} \,|\, \texttt{Started}$

in February

Funding

- › Bill & Melinda Gates Foundation
- › Fundação para a Ciência e a Tecnologia
- > European Commission

Vital Domingues · PhD student, 2015 IBB Sumnima Singh · PhD student, 2013 PIBS

 $\textbf{Susana Martins} \cdot \textbf{Masters student} \mid \textbf{Started in September}$

Pedro Ventura · Masters student | Left in August

Sofia Rebelo · Lab Manager

Silvia Cardoso · Research Technician

Joana Gomes · Visitor

- > European Molecular Biology Organization
- European Society of Clinical Microbiology and Infectious Diseases



Main Achievements

We found that disease tolerance to malaria relies on the capacity of renal proximal tubule epithelial cells to detoxify labile iron (Fe)-containing protoporphyrin (heme), which accumulates in plasma and urine during the blood stage of Plasmodium infection. This defense mechanism is controlled by the transcription factor nuclear factor E2-related factor-2 (NRF2), which prevents the development of acute kidney injury (AKI), a clinical hallmark of severe malaria (under revision). In a related project, we collaborated with the group of Maxim N. Artyomov towards their discovery that Itaconate regulates the ΙαΒζ-ATF3 inflammatory axis irrespectively of NRF2 (Nature. 2018 Apr; 556(7702):501-504.).

We found that global and inducible deletion of the Fth component of ferritin in adult mice leads to a functional state of Fe deficiency characterized by a reduction of circulating Fe and concomitant Fe accumulation in the spleen, associated with a profound atrophy of white and brown adipose tissue (i.e. WAT and BAT) as well as with impaired energy expenditure and BAT thermogenesis. Mechanistically this was attributed to Fe accumulation and mitochondrial dysfunction in parenchyma cells, as demonstrated for hepatocytes and adipocytes. This reveals that FTH couples Fe metabolism to energy expenditure and adaptive thermoregulation (under revision). In a related project we collaborated with the group of Anupam Agarwal to reveal that FTH control of energy metabolism impacts on the outcome of pulmonary TB (Front Immunol. 2018; 9: 860).

We also collaborated with Prof. Gabriel Nuñez towards their finding that IL-22 controls iron-dependent nutritional immunity against systemic bacterial infections raising the concept of innate nutritional immunity (*J. Immunol* July 1, 2018, 201 (1) 11-18).

Selected Publications*

- Bambouskova, M., Gorvel, L., Lampropoulou, V., Sergushichev, A., (...) **Soares, M. P.**, (...) & Artyomov, M. N. (2018). Electrophilic properties of itaconate and derivatives regulate the IκΒζ-ATF3 inflammatory axis. *Nature*, 556(7702), 501–504. https://doi.org/10.1038/s41586-018-0052-z
- * The complete list of publications is available on section 3. Publications.
- Núñez, G., Sakamoto, K., & Soares, M. P. (2018). Innate Nutritional Immunity. The Journal of Immunology, 201(1), 11–18. https://doi.org/10.4049/jimmunol.1800325
- Carlos, A. R., Weis, S., & Soares, M. P. (2018). Cross-Talk Between Iron and Glucose Metabolism in the Establishment of Disease Tolerance. Frontiers in Immunology, 9. https://doi.org/10.3389/fimmu.2018.02498

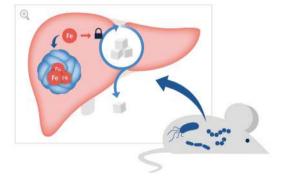


Figure: Sepsis consists of a deregulated body's response to infection, causing metabolic disfunction and organ damage, ultimately leading to death. We discovered a protective mechanism against this condition conferring disease tolerance to sepsis. We showed that iron metabolism controls the production of glucose (sugar) in the liver, so that glucose can be used as a vital source of energy preventing metabolic disfunction and organ collapse.

Evolution and Development

Group Leader | SUCENA, Élio

Research Interests

Our lab explores the interplay between evolutionary and developmental biology. Studying this interface provides insight into the mechanisms at either level, as well as their interaction, ultimately shaping biological variation and diversity. We approach this concept experimentally using

the comparative method and through experimental evolution. Using *Drosophila melanogaster* as a reference model, and other insect species, we seek a mechanistic understanding of the immune response at the genetic, physiological and population levels.



Lab Members in 2018

Kohtaro Tanaka · Postdoc | Left in November Ana Catarina Morais · PhD student, 2016 IBB Catarina Nunes · PhD student, 2016 IBB Tânia Paulo · PhD student, 2017 IBB Filipa Santos · Masters student | Started in September Joana Carvalho · Technician

Nuno Martins · Trainee | Started in March



Main Achievements

We have shown that spider mites may rely mostly on avoidance behaviours to minimize bacterial infection, highlighting the multi-layered nature of immune strategies present in arthropods. This multi-layered concept of immunity also manifests in the accumulating evidence that endosymbionts can shape host adaptation. We selected for 20 generations of infection after removal of Wolbachia from a D. melanogaster population adapted to DCV infection for 35 generations. We showed that the major genes involved in the first selection experiment, pastrel and Ubc-E2H, continued

to be selected in *Wolbachia*-free *D. melanogaster*, albeit with increased frequencies. Finally, in collaboration with the Flatt lab, we analyzed the genomes of a set of *D. melanogaster* lines that have been maintained under indirect selection for longevity for over 35 years. In contrast to control flies, long-lived flies downregulate the expression of antimicrobial peptides upon infection with age yet survived fungal, bacterial, and viral infections significantly better, consistent with alleviated immune-senescence.

Publications

- Faria, V. G., Martins, N. E., Schlötterer, C., & Sucena, É. (2018). Readapting to DCV Infection without Wolbachia: Frequency Changes of *Drosophila* Antiviral Alleles Can Replace Endosymbiont Protection. *Genome Biology and Evolution*, 10(7), 1783-1791. https://doi.org/10.1093/gbe/evy137
- Fabian, D. K., Garschall, K., Klepsatel, P., Santos-Matos, G., **Sucena**, É., Kapun, M., Lemaitre, B., Schlötterer, C., Arking, R., & Flatt, T. (2018). Evolution of
- longevity improves immunity in *Drosophila*. *Evolution Letters*, 2(6), 567–579. https://doi.org/10.1002/evl3.89
- Zélé, F., Santos-Matos, G., Figueiredo, A. R. T., Eira, C., Pinto, C., Laurentino, T. G., Sucena, É., & Magalhães, S. Spider mites escape bacterial infection by avoiding contaminated food. *Oecologia*, 189(1), 111–122. (in press) https://doi.org/10.1007/s00442-018-4316-y

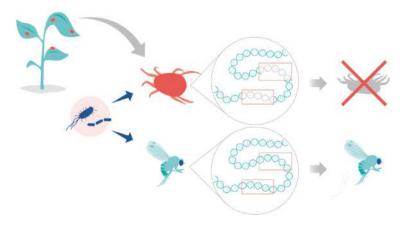


Figure: Spider mites are tiny animals that can have a devastating impact on crops. Unlike other arthropods, these animals lack some immune genes in their genome (red rectangles). Now, we showed that spider mites cannot mount an effective immune response and rapidly die when infected with bacteria but are capable of avoiding contaminated food.

Host-Microorganism Interactions

Group Leader | TEIXEIRA, Luís

Research Interests

Multicellular organisms and microorganisms are continuously interacting. Many of these interactions are mutually beneficial. However, multicellular organisms have to actively thwart invasion by opportunistic or overtly pathogenic microbes. We are studying the interaction of the model organism *Drosophila melanogaster* with different microorganisms. *D. melanogaster* has been successfully used as a model system to study innate immunity against many pathogens. We are investigating mechanisms of resistance to viruses in the fruit fly, some of which are conserved between insects and mammals. Interestingly, we have

found that the intracellular bacterium Wolbachia confers resistance to RNA viruses in D. melanogaster. We want to understand the molecular basis of this induced resistance and the interplay between Drosophila and Wolbachia itself. These endosymbionts are one of the most widespread intracellular bacteria in the world but little is known, at the molecular level, on they interact. Finally, we are also studying the gut microbiota of Drosophila. We want to understand which microbial communities can colonize and proliferate in this environment and how are these specified and regulated.



Lab Members in 2018

Elves Duarte · Postdoc Rupinder Kaur · Postdoc

Sérgio López Madrigal · Postdoc | Started in April

Nelson Martins · Postdoc

Catarina Carmo · Postodoc | Started in October

Inês Pais · Postdoc

Gonçalo Matos · PhD Student, 2017 IBB Marta Silva · Masters Student/ Technician

Rita Valente · Lab Manager

Rafael Caetano · Technician | Started in May

Ana Carvalho · Trainee / Master student

Gustavo Eduardo · Technician Miguel Landum · Technician



Main Achievements

We have identified and characterized bacteria that can colonize and proliferate the gut of *Drosophila melanogaster* (Pais et al. 2018). We further showed that the prevalent *Acetobacter*

thailandicus is a mutualist of *D. melanogaster*. It can be disseminated in the environment by the host and in turn promotes the development of *Drosophila* in a fruit substrate.

Publications

- Gordon, O., Henry, C. M., Srinivasan, N., Ahrens, S., Franz, A., Deddouche, S., Chakravarty, P., Phillips, D., George, R., Kjaer, S., Frith, D., Snijders, A. P., Valente, R. S., Simoes da Silva, C. J., Teixeira, L., Thompson, B., Dionne, M. S., Wood, W., & Reis e Sousa, C. (2018). α-actinin accounts for the bioactivity of actin preparations in inducing STAT target genes in *Drosophila melanogaster*. *ELife*, 7. https://doi.org/10.7554/eLife.38636
- Pais, I. S., Valente, R. S., Sporniak, M., & Teixeira, L. (2018). *Drosophila melanogaster* establishes a species-specific mutualistic interaction with stable gut-colonizing bacteria. *PLOS Biology*, 16(7), e2005710. https://doi.org/10.1371/journal.pbio.2005710
- Chrostek, E., & Teixeira, L. (2018). Within host selection for faster replicating bacterial symbionts. *PLOS ONE*, 13(1), e0191530. https://doi.org/10.1371/journal.pone.0191530

Funding

- > Fundação para a Ciência e a Tecnologia (FCT)
- › European Research Council
- Fundos Europeus Estruturais e de Investimento (FEEI), Programa Operacional Regional Lisboa 2020 and FCT

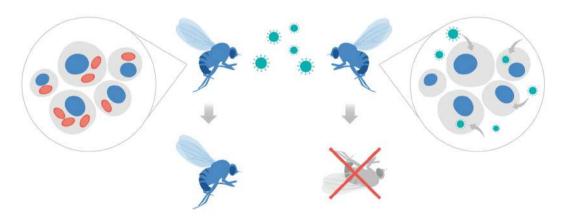


Figure: Many viral diseases, such as Dengue or Zika, are transmitted to humans via insects. An unforeseen ally in fighting this kind of viral diseases is *Wolbachia* (red), a bacterium that naturally infects insects and protects them against viral infections. Using fruit flies as an insect model, we are studying the genes of *Wolbachia* and of the host that are involved in antiviral protection.

Physical Principles of Nuclear Division

Group Leader | TELLEY, Ivo A.

Research Interests

We are a multidisciplinary team interested in the physical aspects of intracellular organization. As a model system, we study the earliest stages of *Drosophila* development, from the oocyte to fertilization to preblastoderm cleavages. Our group is developing three research tracks: We focus on minimal chemical and physical cues that determine oocyte polarity. We study the chemo-mechanical mechanisms leading to pronuclear fusion in the fertilized egg, and how the syncytial

embryo defines the inter-nuclear distance during syncytial divisions. Taking our fundamental research one step further, we investigate how intracellular microbes modulate these early developmental events to their advantage. The scientific methods we adopt are reconstitution approaches in egg explants, physical and chemical manipulation combined with time-lapse light microscopy and image processing while taking advantage of *Drosophila* genetics.



Lab Members in 2018

Jorge Carvalho · Postdoc

Ojas Deshpande · Postdoc

Amid Massouh · Postdoc

Diana Vieira · Postdoc

Margarida Araújo · PhD student, 2017 IBB

Ana Milas · PhD student, 2018 IBB | Started in February

Catarina Nabais · PhD student, 2014 IBB Pedro Sampaio · External PhD student Gustavo Eduardo · Technician



Main Achievements

We have concluded our work on nuclear positioning in the *Drosophila* syncytial embryo — the publications are underway. We pinpoint genes and show the cellular function of the corresponding proteins for distance maintenance between nuclei. We explain nuclear distribution with physical principles of dipole

repulsion. In 2018, we have also worked towards increasing the precision of our previously published *ex vivo* experimental assay, which puts us in a unique position to study the fundamental requirements for and the spatial effects on cell polarization using *in vitro* and *in vivo* approaches.

Publication

de-Carvalho, J., Deshpande, O., Nabais, C., & Telley,
 I. A. (2018). A cell-free system of *Drosophila* egg explants supporting native mitotic cycles. In *Methods in Cell Biology* (Vol. 144, pp. 233–257). Elsevier. https://doi.org/10.1016/bs.mcb.2018.03.011

Funding

- > Fundação para a Ciência e a Tecnologia
- > Human Frontiers Science Program

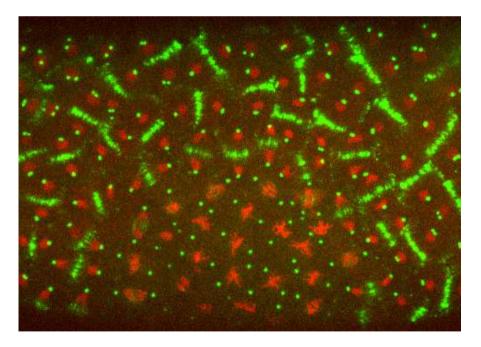


Figure: Confocal fluorescence image of a Blastoderm *Drosophila* embryo showing the spindle midzone protein Facetto (green) helping the mitotic spindle separating chromosomes (red).

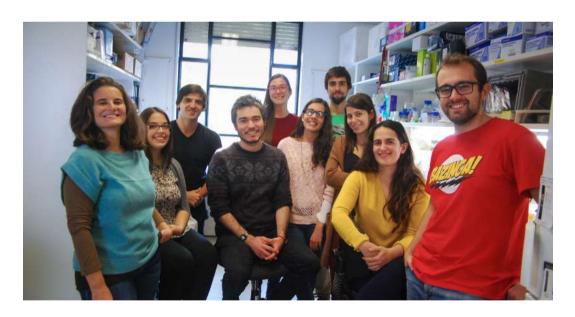
Bacterial Signalling

Group Leader | XAVIER, Karina B.

Research Interests

Bacteria coordinate group behaviours through production, release, and detection of small chemical signals, autoinducers, via a cell-cell signalling process called *quorum* sensing. Many of these behaviours are important in the regulation of virulence and many other functions involved in bacteria-host interactions. The bacteria-host

interactions controlled by *quorum* sensing include interactions, which are hostile or beneficial for the host. We are interested in understanding how bacterial signalling shapes the multi-species bacterial communities that can be found in animals and plants and how these communities affect host physiology.



Lab Members in 2018

Vitor Cabral · Postdoc Tanja Dapa · Postdoc

Ana Rita Oliveira · PhD student, 2015 IBB

Ozhan Ozkaya · PhD student Inês Torcato · PhD student Filipe Vieira · PhD student

Margarida Correia · Masters student

Joana Amaro · Lab manager

Carina Galhofa · Technician | Started in April

Miguel Pedro · Technician



Main Achievements

We determined the resilience of mice gut microbiota to antibiotic-induced dysbiosis under conditions where interaction among hosts is either enabled or prevented. Functional consequences of streptomycin-induced dysbiosis were assessed by determining colonization resistance capacity of the microbiota against expansion of intestinal *Escherichia coli*. Strikingly, while post-antibiotic microbiota all cohoused animals retained the ability to provide

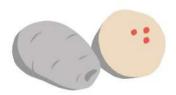
colonization resistance against *E. coli*, this property was lost in all but one of the single-housed mice. We identified a member of the mouse microbiota, which was sufficient to explain colonization resistance against *E. coli*. This work highlights the importance of housing conditions in facilitating the reacquisition of natural commensals following perturbations caused by antibiotics or other drugs.

Selected Publications

- Özkaya, Ö., Balbontín, R., Gordo, I., & Xavier, K. B. (2018). Cheating on Cheaters Stabilizes Cooperation in *Pseudomonas aeruginosa. Current Biology*, 28(13), 2070–2080.e6. https://doi.org/10.1016/j.cub.2018.04.093
- Cabral, V., & Xavier, K. B. (2018). Bacterial Call to Arms for Warfare at the Infection Site. *Cell Host & Microbe*, 23(3), 285–287. https://doi.org/10.1016/j.chom.2018.02.009
- Xavier, K. B. (2018). Bacterial interspecies quorum sensing in the mammalian gut microbiota. Comptes Rendus Biologies, 341(5), 300. https://doi. org/10.1016/j.crvi.2018.04.004

Funding

- > Fundação para a Ciência e a Tecnologia (FCT)
- Fundos Europeus Estruturais e de Investimento (FEEI),
 Programa Operacional Regional Lisboa 2020 and FCT
- > European Commission



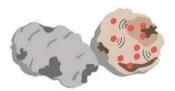
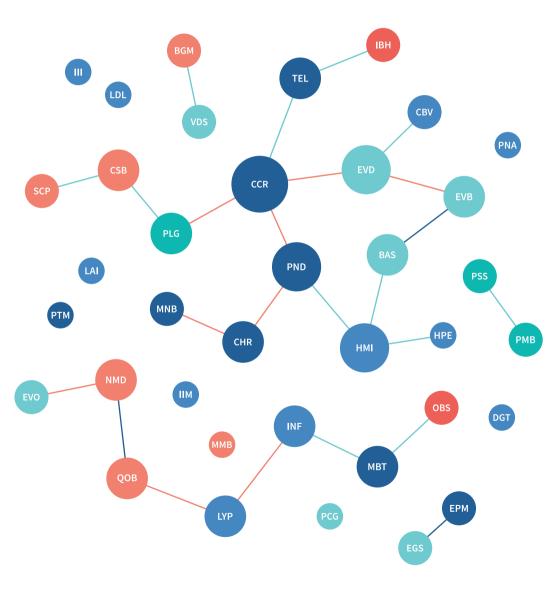




Figure: Bacteria "talk" to each other using a language of small chemical molecules that are released to the environment and sensed by other bacteria. We discovered that the virulence of *Pectobacterium wasabiae* (red), a plant pathogen, can be triggered earlier, even at low densities, if these bacteria eavesdrop on signals released by other pathogenic species (blue) present in the environment.

In-House Collaborations 2018



Joint publication
Lab collaboration
Shared PhD student

	Cell and Developmental Biology
MBT	Membrane Traffic Adrain, Colin
CCR	Cell Cycle Regulation Bettencourt Dias, Mónica
MNB	Molecular Neurobiology Castro, Diogo S.
TEL	Telomeres and Genome Stability Ferreira, Miguel Godinho
EPM	Epigenetic Mechanisms Jansen, Lars E.T.
PTM	Patterning and Morphogenesis Mallo, Moisés
CHR	Chromosome Dynamics Oliveira, Raquel A.
PND	Physical Principles of Nuclear Division Telley, Ivo A.
	Quantitative and Computational Biology
BGM	Biophysics and Genetics of Morphogenesis Alves, Filipa
QOB	Quantitative Organism Biology Carneiro, Jorge
NMD	Network Modelling Chaouiya, Claudine
MMB	Mathematical Modelling of Biological Processes Gjini, Erida
SCP	Science and Policy Gonçalves-Sá, Joana
CSB	Complex Adaptive Systems and Computational Biology Rocha, Luís M.
	Plant Biology
PSS	Plant Stress Signalling Baena González, Elena
PLG	Plant Genomics Becker, Jörg
PMB	Plant Molecular Biology Duque, Paula
	Immunobiology
CBV	Cell Biology of Viral Infection Amorim, Maria João
PNA	Protein - Nucleic Acids Interactions Athanasiadis, Alekos
LYP	Lymphocyte Physiology Demengeot, Jocelyne
LAI	Lupus and Autoreactive Immune Repertoires Fesel, Constantin
HPE	Host-Pathogen Co-Evolution Howard, Jonathan C.
LDL	Lymphocyte Development and Leukemogenesis Martins, Vera
III IIM	Innate Immunity and Inflammation Moita, Luís Ferreira Infections & Immunity Parkhouse, Michael
DGT	Disease Genetics Penha Gonçalves, Carlos
INF	Inflammation Soares, Miguel P.
НМІ	Host-Microorganism Interactions Teixeira, Luís
	Evolutionary Biology
EVD	Evolutionary Dynamics Bank, Claudia
VDS	Variation: Development and Selection Beldade, Patrícia
PCG	Population and Conservation Genetics Chikhi, Lounès
EVB	Evolutionary Biology Gordo, Isabel
EGS	Evolution and Genome Structure Perfeito, Lília
EVO	Evolution and Development Sucena, Élio
BAS	Bacterial Signalling Xavier, Karina B.
	Neurobiology
OBS	Obesity Domingos, Ana I.

Integrative Behavioural Biology | Oliveira, Rui F.

IBH

External Collaborations 2018

In 2018, the IGC researchers collaborated with researchers from the following external institutions:

EUROPE

Aarhus University, Denmark Aix-Marseille Université, France

Barts Institute, UK

Cardiff University, UK

Center for Sepsis Control and Care (CSCC), Germany

Centre de Physique Theorique, Campus de Luminy, France

Centre for Genomic Regulation (CRG), Spain

Centro de Estudos de Doenças Crónicas (CEDOC), Portugal

Centro de Investigación en Medicina Molecular

y Enfermedades Crónicas (CiMUS), University of Santiago

de Compostela, Spain

Centro Nacional de Biotecnología, Spain

Centro Nacional de Supercomputación (CNS), Spain

Champaulimaud Centre for the Unknown, Portugal

Centro de Investigaciones Biológicas (CIB-CSIC), Spain

Centro Singular de Investigaciones en Medicina Molecular y

Enfermedades Crónicas (CiMUS), Universidade de Santiago

de Compostela, Spain

Comprehensive Heart Failure Center, Germany

DFG-Research Center Matheon, Free University

of Berlin, Germany

Edinger Institute of Neurology, Frankfurt Medical

School, Germany

European Molecular Biology Laboratory (EMBL), Germany

École Normale Supérieure (ENS), Paris, France

Friedrich Schiller University, Germany

Gregor Mendel Institute, Vienna, Austria

Hospital Curry Cabral, Portugal

Hospital de Santo António, Universidade do Porto, Portugal

Hospital Santa Maria, Portugal

Institut de Méchanique et d'Ingénierie (I2M), France

Instituto de Biologia Molecular y Celular de Plantas (IBMCP),

UPV-CSIC, Spain

Instituto de Ciências Biomédicas Abel Salazar (ICBAS),

Universidade do Porto, Portugal

Imperial College London, UK

Institut Curie, France

Institut de Mathématiques de Toulouse, France

Institut National de la Recherche Agronomique, France Institut Necker-Enfants Malades (INEM), France

Institute for Stroke and Dementia Research, University

of Munich, Germany

Institute of Biological and Medical Imaging, Helmholtz

Zentrum München, Germany

Institute of Innate Immunity, Biomedical Center, University

of Bonn, Germany

Institute of Organic chemistry and Biochemistry, Czech

Academy of Sciences, Czech Republic

Instituto de Investigação e Inovação em Saúde (I3S), Portugal

Instituto de Medicina Molecular (iMM), Portugal

Instituto de Tecnologia Química e Biológica António Xavier

(ITQB/NOVA), Portugal

Instituto Politécnico Leiria, Portugal

Instituto Português de Oncologia (IPO), Portugal

Instituto Superior Técnico (IST), Portugal

Ipatimup, Portugal

ISI Foundation, Italy

Institute of Science and Technology Austria (IST Austria),

Austria

Karolinska Institute, Sweden

Koç University, Turkey

laboratoire Evolution et Diversité Biologique, France

Leiden University Medical Center, The Netherlands

LMC, Netherlands

London School of Hygiene and Tropical Medicine, UK

Max Planck Institute, Germany

Ministério da Educação e da Ciência, Portugal

MRC Centre for Regenerative Medicine, University

of Edinburgh, UK

NOVASBE, Portugal

Pasteur Institute, France

Pirbright Institute, UK

Radboud University Medical Center, The Netherlands

Sainsbury Laboratory, Cambridge University, UK

San Rafaelle Scientific Institute, Italy

Sorbonne University, Paris, France

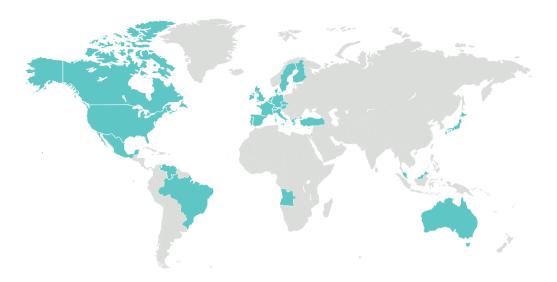
Trinity College, Dublin, Ireland

TWINCORE, Centre for Experimental and clinical infection

research, Germany

Umeå University, Sweden

Universidade de Aveiro, Portugal



Universidade do Algarve, Portugal Universidade Nova de Lisboa, Portugal Universitat de València, Spain University of Bielefeld, German

University of Bristol, UK

University of Cologne, Germany

University of Copenhagen, Denmark

University of Edinburgh, UK

University of Freiberg, Germany

University of Freiburg, Germany

University of Geneva Sciences III, Switzerland

University of Glasgow, UK

University of Helsinki, Finland

University of Leicester, UK

University of Leuven, Belgium

University of Liverpool, UK

University of Manchester, UK

University of Neuchâtel, Switzerland

University of Oxford, UK

University of Patras, Greece

University of Santiago de Compostela, Spain

University of Sheffield, UK

University of Southern Denmark, Denmark

University of Tours, France

University of Veterinary Medicine, Germany

University of Vienna, Austria

Vlaams Instituut voor Biotechnologie (VIB), Belgium

Welcome Centre for Cell Biology, UK

Zentrum für Molekulare Biologie der Universität Heidelberg (ZMBH), Germany

AMERICA

Arizona State University, USA Carleton University, Canada Dana Farber, USA Indiana University, USA

Montreal Neurological Institute, McGill University, Canada

Ottawa University, Canada

Rush University, Chicago, USA

Stanford University, USA

Swarthmore College, USA

Temple University, Philadelphia, USA

Universidad Nacional Autónoma de México (UNAM), Mexico

Universidad de Carabobo, Venezuela

Universidade Federal do Rio de Janeiro, Brazil

Universidade de São Paulo, Brazil

University of Alabama at Birmingham, USA

University of California, USA

University of Delaware, USA

University of Maryland, USA

University of Massachusetts Medical School, USA

University of Michigan Medical School, USA

University of Michigan, USA

University of Ottawa, Canada

University of Tennessee, USA

Virginia Tech, USA

ASIA

Mechanobiology Institute (MBI Singapore), Singapore Nanyang Technological University, Singapore National Institute of Genetics, Japan Weizmann Institute, Israel Danau Girang Field Center, Malaysia

AFRICA

Faculdade de Medicina de Benguela, Angola

OCEANIA

Monash University, Australia

External Associated Groups 2018

The following researchers develop their scientific programmes at external associated institutes and research centres, maintaining strong scientific collaborations with IGC groups, and access to IGC facilities

BELO, José António

CEDOC – Chronic Diseases Research Center, Faculdade de Ciências Médicas, Universidade Nova de Lisboa, Portugal

CAREY, Megan

Champalimaud Research, Portugal

COSTA, Rui M.

Columbia's Zuckerman Institute, USA and Champalimaud Research, Portugal

DIAS, Sérgio

Instituto de Medicina Molecular, Portugal

DIONÍSIO, Francisco

Faculdade de Ciências da Universidade de Lisboa, Portugal

DUARTE, António

Centre for Interdisciplinary Research in Animal Health (CIISA), Faculdade de Medicina Veterinária, Universidade de Lisboa

FARO, José

Universidad de Vigo, Spain

FERNANDES, Lisete

Biosystems and Integrative Sciences Institute (BioISI), Portugal

GRAÇA, Luís

Instituto de Medicina Molecular, Portugal

HENRIQUE, Domingos

Instituto de Medicina Molecular, Portugal

ISRAELY, Inbal

Department of Pathology and Cell Biology, Columbia University, USA

JACINTO, António

CEDOC – Chronic Diseases Research Center, Faculdade de Ciências Médicas, Universidade Nova de Lisboa, Portugal

LIMA, Susana

Champalimaud Research, Portugal

MAINEN, Zachary

Champalimaud Research, Portugal

MARTINHO, Rui

Centre for Biomedical Research, Universidade do Algarve, Portugal

MOITA, Marta

Champalimaud Research, Portugal

MOTA, Maria

Instituto de Medicina Molecular, Portugal

MOTA VIEIRA, Luísa

Divino Espírito Santo Hospital, Universidade dos Açores, Azores, Portugal

OLIVEIRA, Sofia

Instituto de Medicina Molecular, Portugal

ORGER, Michael

Champalimaud Research, Portugal

PATON, Joseph

Champalimaud Research, Portugal

RIBEIRO, Carlos

Champalimaud Research, Portugal

SAÚDE, Leonor

Instituto de Medicina Molecular, Portugal

SILVA SANTOS, Bruno

Instituto de Medicina Molecular, Portugal

SIMAS, João Pedro

Instituto de Medicina Molecular, Portugal

SOARES, Helena

Faculdade de Ciências da Universidade de Lisboa, Portugal

THORSTEINSDÓTTIR, Solveig

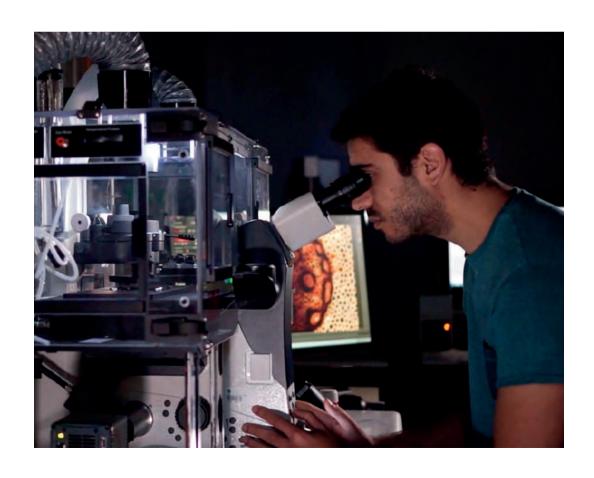
Faculdade de Ciências da Universidade de Lisboa, Portugal

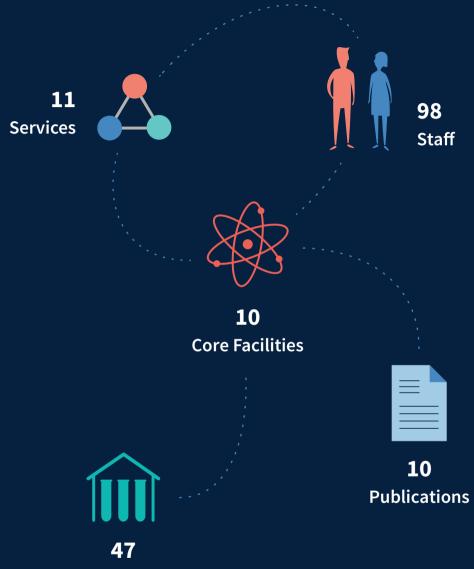
VASCONCELOS, Maria Luísa

Champalimaud Research, Portugal

VICENTE, Astrid

BioSystems & Integrative Sciences Institute (BioISI), Universidade de Lisboa, Portugal and Instituto Nacional de Saúde Dr. Ricardo Jorge, Portugal





External Institutions that used the facilities/services

SUPPORT TO RESEARCH

Animal House Facility

Head | REBELO, Manuel



Staff in 2018

Jocelyne Demengeot · Scientific Coordinator
Joana Bom · Manager of the Mouse Facility
Ana Cristina Borges · Manager of the Aquatic Facility

Liliana Vieira Manager of the Fly Facility

Sandra Crisóstomo · Technician Maysa Franco · Technician Ana Sofia Leocádio · Technician Carina Monteiro · Technician

Marília Pereira · Technician Pedro Pinto · Technician

Ana Ribeiro · Technician Inês Santos · Technician Liliana Vale · Technician

Adérito Vieira · Technician Carla Almada · Animal care staff Cláudia Gafaniz · Animal care staff

João Lopes · Animal care staff Lévi Pires · Animal care staff

Graça Ramalho • Animal care staff | Left in February

Marco Rocha · Animal care staff Mário Rocha · Animal care staff Carine Santos · Animal care staff

New Equipment in 2018

- 2 Changing stations ISO 4 ARIA CS-60; funded by FEDER-FCT (CONGENTO);
- > 1 Rigid Isolator; Isolab H2; funded by FEDER-FCT

Description of Facility

The Animal House Facility (AHF) is a Core Facility that provides infrastructure and services for model organism-based research at the IGC that includes Rodent, Aquatic (zebrafish, killifish, and frog) and Fly Facilities. The AHF seeks to integrate management of the different animal facilities, namely by sharing technological development and good practices among different animal models. The AHF staff duties include husbandry procedures, general maintenance of facilities and equipment, advanced services such as rederivation, cryopreservation, gnotobiology, production of germ-free animals, assistance to researchers, colony maintenance, animal importation and exportation, organisation of Laboratory Animal Science (LAS) courses, and support on legal issues. The AHF team is composed by managers, specialised technicians and caretakers for each species, while at the same time combining flexibility and adaptability: personnel is trained in more than one species, allowing the Core Facility to easily adapt to research dynamics. This particularity promotes a culture of shared values and principles that contributes to a close relation with the researchers.

News in 2018

The IGC signed the Transparency Agreement on animal research in Portugal in June, being one of the 16 Portuguese institutions including Research Centres and Universities that have signed this agreement.

The 1st CONGENTO Annual Meeting (resulting from the National Research Infrastructures Roadmaps) was organised at the IGC in October.

(CONGENTO);

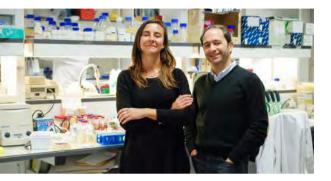
1 Autoclavable Container for Isolab H2; E-411047.01; funded by FEDER-FCT

Email · mrebelo@igc.gulbenkian.pt

IGC Webpage · http://www.igc.gulbenkian.pt/facilities/animals

Transgenics Unit

Head | MALLO, Moisés



Staff in 2018

Ana Nóvoa · Technician

Publications

Aires, R., de Lemos, L., Nóvoa, A., Jurberg, A. A., Mascrez, B., Duboule, D., & Mallo, M. (2018) Tail Bud Progenitor Activity Relies on a Network Comprising Gdf11, Lin28, and Hox13 Genes. *Developmental Cell*. https://doi.org/10.1016/j. devcel.2018.12.004

Description of Facility

The Transgenics Unit generates genetically modified mouse strains for research groups at the IGC. We also collaborate with researchers in other institutions to produce genetically modified mouse models.

Our work with mice includes:

- Production of transgenic mice by pronuclear DNA injection using both conventional expression constructs and bacterial artificial chromosomes (BACs);
- Introduction of targeted modifications into endogenous genomic loci both following embryonic stem cell-mediated approaches and with the CRISPR/Cas9 technology.
- Production of mouse chimeras through microinjection of embryonic stem cells.

News in 2018

During 2018 we produced 38 mouse lines and embryos from 21 different projects to introduce targeted genomic modifications using CRISPR/Cas9. These included straight knock-outs, knockins (introducing epitope and fluorescent tags and various versions of the cre recombinase), introduction of specific modifications (including point mutations and specific deletions), engineering complex replacements of functional modules and introduction of LoxP sites. During this year, we started to use synthetic RNAs as guides in our microinjections, replacing the transcriptionally-generated gRNAs. We also produced 366 transgenic mice or embryos from 23 different DNA constructs and 8 lines from one BAC construct.

We also generated chimeric mice from two different mutant ES cell lines of the C57Bl/6 background, producing chimeras with germ line transmission for both of cell lines.

Plant Facility



Staff in 2018

Vera Nunes · Technician

Description of Facility

The IGC Plant Facility ensures the proper growth and maintenance of *Arabidopsis thaliana* and *Physcomitrella patens*, the two model organisms used by the three plant research groups hosted by the IGC (Plant Genomics, Plant Molecular Biology, and Plant Stress Signaling). Another model organism, *Nicotiana benthamiana*, is also provided by the Facility for occasional usage.

The Plant Facility provides a variety of controlled-environment plant growth spaces, offering also dedicated technical support. It is equipped with three custom-made, fully-controlled growth rooms with short-day and long-day light settings, as well as a walk-in plant growth chamber and seven reach-in chambers that allow the performance of more precise phenotypical analyses and cell-based assays. The Plant Facility also includes a soil house, used for all necessary plant manipulations and for storage of supplies, as well as a temperature-controlled room for plant drying and seed production.

Funding from Calouste Gulbenkian Foundation, Portugal

Publications

Pedrotti, L., Weiste, C., Nägele, T., Wolf, E., Lorenzin, F., Dietrich, K., Dietrich, K., Mair, A., Weckwerth, W., Teige, M., Baena-González, E. & Dröge-Laser, W. (2018).
Snf1-RELATED KINASE1-Controlled C/S -bZIP Signaling Activates Alternative Mitochondrial Metabolic Pathways to Ensure Plant Survival in Extended Darkness.
The Plant Cell, 30(2), 495–509. https://doi.org/10.1105/tpc.17.00414

Bioinformatics and Computational Biology Unit

Head | SOBRAL, Daniel



Staff in 2018

Daniel Faria · Postdoc (Elixir-Excelerate)
Tiago Macedo · System administrator | Left in March
Maria Belén Carbonetto · Bioinformatics specialist (ONEIDA)
João Costa · Bioinformatics specialist
Daniel Neves · Bioinformatics specialist (BioData.pt)
Cirenia Baldrich · Bioinformatics specialist (BioData.pt) |
Started in September

Publications

- Siwek, W., Gómez-Rodríguez, M., Sobral, D., Corrêa, I. R., & Jansen, L. E. T. (2018). time-ChIP: A Method to Determine Long-Term Locus-Specific Nucleosome Inheritance. In G. A. Orsi & G. Almouzni (Eds.), *Histone Variants* (Vol. 1832, pp. 131–158). New York, NY: Springer New York. https://doi.org/10.1007/978-1-4939-8663-7_7
- Faria, D., Pesquita, C., Mott, I., Martins, C., Couto, F. M., & Cruz, I. F. (2018). Tackling the challenges of matching biomedical ontologies. *Journal of Biomedical Semantics*, 9(1). https://doi.org/10.1186/s13326-017-0170-9

Description of Facility

The Bioinformatics Unit (UBI) provides consulting services in bioinformatics and computational biology. We provide a broad range of support for ongoing studies requiring external expertise in bioinformatics, including: training and consulting on the use of bioinformatic tools; development of databases and data-warehousing solutions; development of bioinformatics pipelines for genomic analysis; next generation sequencing (NGS) data analysis. The UBI is part of the BioData.pt national infrastructure, and participates in european networks within the ELIXIR European infrastructure.

News in 2018

The Bioinformatics Unit has provided more than 1000 hours of direct support to IGC research groups, and 120 hours to external users (now as BioData.pt). We have recruited a new bioinformatics specialist to initiate the development of a web portal for genomic data of the cork oak. Within the context of our national and international collaborations we organised workshops for metagenomic data analysis. We continued our collaboration with the GTPB programme by providing practical courses on RNA-Seq and introductory NGS data analysis. We continue providing training in the context of PhD and MSc level programs. Namely, we have organised a one week course on "Research in Bioinformatics" from the Masters in Bioinformatics of the University of Lisbon.

Software Development in 2018

Go Enrichment: Performs GO Enrichment analysis.
 Website: https://github.com/DanFaria/GOEnrichment

Genomics Unit

Head | BECKER, Jörg



Staff in 2018

Carlos Penha Gonçalves · Scientific Adviser

João Sobral · Technician

Sara Ramos · Technician | Left in February

Susana Ladeiro · Technician João Costa · Technician

Carla Rodrigues · Technician | Started in March

New Equipment in 2018

> 10X Genomics Chromium Single Cell Controller, GenomePT (Lisboa-01-0145-FEDER-022184), funded by FEDER-FCT (GenomePT)

Selected Publications*

- Prudêncio, P., Guilgur, L. G., Sobral, J., Becker, J. D., Martinho, R. G., & Navarro-Costa, P. (2018). The Trithorax group protein dMLL3/4 instructs the assembly of the zygotic genome at fertilization. EMBO Reports, 19(8), e45728. https://doi.org/10.15252/ embr.201845728
- Misra, C. S., Santos, M. S., Rafael-Fernandes, M., Martins, N. P., Monteiro, M., & Becker, J. D. Transcriptomics of Arabidopsis sperm cells at single-cell resolution. Plant Reproduction. (in press)

Description of Facility

The Genomics Unit provides a large portfolio of NGS and Genotyping services from bulk sample analysis down to single cell level. We are equipped with Illumina NextSeq 500 and MiSeq platforms, 10X Genomics Chromium Single Cell Controller, Oxford Nanopore MinIon and MassArray. We provide a complete service from advice on experimental design, over sample processing to data delivery. Our services include:

- Genome sequencing (Illumina)
- Long-read sequencing (Nanopore)
- > Single cell genomics (10X Genomics)
- Genotyping (MassArray)
- > RNA-Seq
- > 16S Metagenomics
- > ChIP-Seq
- › Nucleic Acid QC

News in 2018

The Gene Expression and Genomics Units were fused in January 2018, and the unit moved to new premises with dedicated equipment room and new Pre-PCR room during the spring. With the acquisition of a 10X Genomics Chromium Single Cell Controller we could add single cell analyses to our portfolio.

In 2018 the Genomics Unit has processed 2124 samples for re-sequencing, 2587 samples for 16S metagenomics, 438 samples for RNA-Seq (267of SMART-Seq2 and 171 of QuantSeq), 52 samples for ChIP-Seq and 6 samples for custom amplicon experiments. Additionally we have analysed more than 6300 samples (RNA or DNA) on our Fragment Analyzer and almost 7500 samples on our Sanger Sequencer.

Histopathology Unit

Head | FAÍSCA, Pedro



Staff in 2018

Joana Rodrigues Lóis · Histology Technician Cláudia Faria · Histology Technician | Started in May Marta Pinto · Histology Technician | Left in March

News in 2018

- > Implementation of Stereology as a service;
- The Unit received two externship students from Universidade Lusófona and Universidade de Évora, and two students (one from Portugal and the other from Serbia) in a Summer school;
- The HU supported 3 publications from users of the facility.

Description of Facility

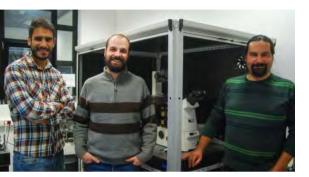
The Histopathology Unit (HU) has two major roles: provide high quality preparations for microscopy and pathology support to IGC scientists investigating animal models of human disease. Our technicians guide the users in their work and offer training in some of the equipment available. An in-house veterinary pathologist gives histology and comparative pathology assessment, assists in study design and manuscript preparation. Therefore, the HU provides the following services: Processing and Paraffin Embedding; Microtome Sectioning; Cryostat sectioning; Vibratome sectioning; H&E staining and special staining; Training for new users in sample preparation, cryostat sectioning, and vibratome sectioning; Planning and implementation of different histological techniques including Immunohistochemistry; Morphology and morphometry assessment; Bright-field Image analysis; Stereology; High quality image acquisition and slide scanner.

Health monitoring of the institute's animal models, namely zebrafish, is also a main task undertaken by our unit, performing routine histological analysis on periodically selected animals.

The Histopathology Unit is open to all internal groups in IGC but also to associate laboratories, academic institutions and private companies.

Advanced Imaging Unit

Head | MARTINS, Gabriel



Staff in 2018

Nuno Pimpão Martins · Microscopy Technician
Hugo Pereira · Microscopy Technician & Developer | Left in Nov.

New Equipment in 2018

- > Amira software; funded by FEDER-FCT (PPBI).
- > O2 controller; funded by FEDER-FCT (PPBI).
- > Fluorescence Illuminator; funded by FEDER-FCT (PPBI).
- High-end processing workstation for image restoration/processing; funded by IGC.

Software Development in 2018

 Several, macros/scripts for automation of image analysis, available through facility website: http://facilities.igc. gulbenkian.pt/microscopy/microscopy-macros.php

Selected Publications*

Marteil, G., Guerrero, A., Vieira, A. F., de Almeida, B. P.,
 Machado, P., Mendonça, S., Mesquita, M., Villarreal, B.,
 Fonseca, I., Francia, M.E., Dores, K., Martins, N.P., Jana,
 S. C., Tranfield, E. M., Barbosa-Morais, N. L., Paredes, J.,
 Pellman, D., Godinho, S. A., & Bettencourt-Dias, M.
 (2018). Over-elongation of centrioles in cancer
 promotes centriole amplification and chromosome
 missegregation. *Nature Communications*, 9(1).
 https://doi.org/10.1038/s41467-018-03641-x

Description of Facility

The Advanced Imaging Facility provides access and support to high-end optical microscopy to the whole IGC community and neighbouring institutions. The facility currently stands as an international reference, with flagship techniques such as super-resolution, high-throughput widefield, multiphoton, light-sheet microscopy, optical tomography and macro bioluminescence. Some of these techniques are unique in the country and were developed in-house. The unit is also responsible for general maintenance of optical instruments throughout the IGC. Users are trained regularly through personalised training sessions and internal workshops. The unit also organises advanced workshops on light microscopy, equipment setup, experimental design and image analysis.

News in 2018

We organised the EMBO Practical Course on 3D Developmental Imaging on its 10^{th} anniversary edition, and won a FCT grant for development of multimodal mesoscopy (OPT+light-sheet). We established a new high-end image restoration workstation with Huygens, and acquired Amira software for manual segmentation, volume registration and CLEM analysis. A new EMCCD camera in Aequoria luminescence Imager, temperature control in OpenSpin Light-sheet and hyperoxia (O_2) control in Multi-photon system were installed. In 2018, the facility appointed an official Laser Safety Officer.

We co-authored 4 papers and supported more than 20 publications from facility users; presented in 10 national and 7 international meetings/workshops; and co-authored 5 poster presentations. Also, we participated with the installation "Fluoresciência" at NOS Alive and at IGC Open Day.

Electron Microscopy Facility

Head | TRANFIELD, Erin



Staff in 2018

Ana Laura Sousa · Technician Sara Bonucci · Technician

Tomás Silva · Technician | Left in February Clara Barreto · Trainee | Started in December

News in 2018

The IGC is part of a newly funded COST Action – COMULIS – which is aimed at developing multimodal imaging techniques. Erin Tranfield is one of two representatives from Portugal on the Management Committee of this COST Action.

Description of Facility

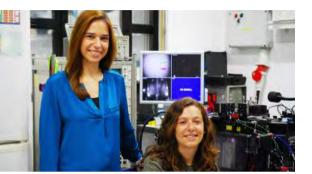
The Electron Microscopy Facility at the IGC helps in-house, national and international scientists apply a wide variety of electron microscopy approaches to their scientific questions. The team performs tasks from simple negative staining experiments to more complex experiments like high pressure freezing and freeze substitution of very delicate samples. Available equipment give users multiple approaches for sample preparation, allowing experiments to be tailored to exactly the question under investigation. The facility is equipped to preserve samples using conventional chemical fixation, microwave chemical fixation, and high pressure freezing. Other methods frequently used are the Tokuyasu technique for immunogold labelling of antigens of interest. The two transmission electron microscopes are able to perform 2D and 3D imaging. The facility does full service work, but we also offer the option for new users to be trained on all aspects of electron microscopy to facilitate their application of electron microscopy to their research.

Publications

- Montenegro Gouveia, S., Zitouni, S., Kong, D., Duarte,
 P., Ferreira Gomes, B., Sousa, A. L., Tranfield, E.M.,
 Hyman, A., Loncarek, J., Bettencourt-Dias, M. (2018).
 PLK4 is a microtubule-associated protein that self-assembles promoting de novo MTOC formation. *Journal of Cell Science*. https://doi.org/10.1242/jcs.219501
- Marteil, G., Guerrero, A., Vieira, A. F., de Almeida, B. P., Machado, P., Mendonça, S., Mesquita, M., Villarreal, B., Fonseca, I., Francia, M.E., Dores, K., Martins, N.P., Jana, S. C., Tranfield, E. M., Barbosa-Morais, N. L., Paredes, J., Pellman, D., Godinho, S. A., & Bettencourt-Dias, M.
- (2018). Over-elongation of centrioles in cancer promotes centriole amplification and chromosome missegregation. *Nature Communications*, 9(1). https://doi.org/10.1038/s41467-018-03641-x
- Gorgulho, R., Jacinto, R., Lopes, S. S., Pereira, S. A., **Tranfield, E. M.**, Martins, G. G., Gualda, E.J., Derks, R. J. E., Correia, A. C., Steenvoorden, E., Pintado, P., Mayboroda, O. A., Monteiro. E. C., & Morello, J. (2018). Usefulness of zebrafish larvae to evaluate drug-induced functional and morphological renal tubular alterations. *Archives of Toxicology*, *92*(1), 411–423. https://doi.org/10.1007/s00204-017-2063-1

Flow Cytometry Facility

Head | MONTEIRO, Marta



Staff in 2018

Mariana Raquel-Fernandes · Flow Cytometry research support specialist Inês Almeida · Flow Cytometry research support specialist

Software Development in 2018

Cell by Cell, videogame aimed at explaining cell sorting to lay audiences: http://facilities.igc.gulbenkian. pt/flowcytometry/cell_by_cell_web/index.html

Publications

Misra, C. S., Santos, M. S., Rafael-Fernandes, M., Martins, N. P., Monteiro, M., & Becker, J. D. Transcriptomics of Arabidopsis sperm cells at single-cell resolution. Plant Reproduction. (in press)

Description of Facility

The Flow Cytometry Facility (IGC-FCF) offers flow cytometry services and expertise to researchers from IGC, as well as to outside groups and companies. The main focus of our services is:

- > to facilitate the access to state-of-the-art flow cytometry techniques and instrumentation;
- to develop and implement new methods and solutions to support project development;
- > to offer scientific and technical consultation;
- to promote advanced training and the best practices in Flow Cytometry.

Instrumentation includes two multicolour highspeed cell sorters, four analysers and a multiplex analyte reader. Laboratory staff is well trained and SOP are implemented to comply with the highest quality standards required to ensure reproducibility in science.

The need to find solutions to support research projects drives a continuous development of the facility, which aims to follow the advances in the flow cytometry field, collaborates with innovative projects, creates novel tools and methods to advance research, and implements strategies to improve the quality of the provided services.

News in 2018

Inês Almeida joined the team increasing our response capacity and reinforcing assets such as data management and analysis. The FCF organized at the IGC, together with other members of FLxFlow, an international Flow Cytometry Course that received more than 70 delegates and was sponsored by 13 companies. Finally, we renovated our website to provide tools better tailored to our users' needs, including protocols, tutorials, etc.

Antibody Service

Head | DEMENGEOT, Jocelyne



Staff in 2018

Ana Regalado · Manager

Description of Facility

The Facility provides support to researchers wishing to produce, purify and label monoclonal antibodies (mAbs). It also maintains a collection of hybridomas and purified and coupled antibodies for IGC investigators.

The Antibody service offers the following services:

- > Quality control of hybridomas:
 - · Mycoplasma testing and cleaning;
 - · Quantification of Ig production by ELISA.
- Small to medium scale Ig production from QC hybridomas in vitro (10 to 100mg):
 - · Optimization of production by sub-cloning;
 - · Adaptation to serum free or IgG depleted media:
 - · Purification by Protein A/G chromatography and protein quantification;
 - · QC by protein gel electrophoresis.
- Conjugation of monoclonal antibodies to small molecules for FACS, Western or immunohistology



Accounting and Internal Audit

Head | LEITE, José Mário | Left in May & SCHMIDT, Manuel | Started in April

Description of Service

This Service provides all accounting, financial and fiscal support to IGC, including accounts payables and general book keeping in coordination with FCG Financial Services.





Staff in 2018

Ana Sofia Oliveira · Team Leader Ana Rita Batalha · Senior Consultant Tânia Lobão · Consultant Filipe Reis · Junior Consultant all from external company PwC

Fátima Mateus · Accounting Officer **Vítor Santos** · Accounts and Information Officer

Biosafety

Head | CARNEIRO, Tiago

Description of Service

The IGC recognises the importance of ensuring the health and safety of all personnel within its campus. The ultimate goal of the biosafety unit is to create a safety awareness culture where safety is so entrenched in everyone that the natural conduct is to support safety practices. Hence, the biosafety unit is committed to make available the adequate resources to support research with all relevant safety statutes, regulations and codes of practice.



News in 2018

The IGC became a member of the European Association for Biosafety (https://ebsaweb.eu/)

General Maintenance

Head | LEITE, José Mário | Left in May & SCHMIDT, Manuel | Started in April

Description of Service

This service provides support in all general maintenance (excluding scientific equipment and units), electricity, AVAC, buildings, gardening, cleaning and gives support to the whokle IGC community. It is also responsible for the garbage removal (general and biohazard), installation and maintenance of all general equipment with connection with FCG and external companies.

News in 2018

Building facade painting, new chiller installation, new liquid nitrogen tank, new lift loader. Several smaller maintenance and cleanup works in IGC Campus.

Informatics Unit

Head | SOUSA, João

Description of Service

The IGC informatics (ITI) manages most of the Information and Communications Technology needs of the IGC including the development and maintenance of the IT and communications infrastructure, direct support to IGC users (helpdesk), training and consulting as a service, development and maintenance of the scientific computation farm, and application development. Most of the IGC infrastructure relies on the use of Open Source technologies and the competence of our dedicated staff to maintain a competitive level of service. Notable exceptions are the dedicated administrative applications that also rely on commercial applications and external consultants to maintain them. The IGC has a modern IT infrastructure with a local data center, redundant internet lines, Giga-



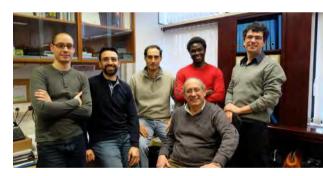
Staff in 2018

Pedro Alves · Technician
João Madureira · Technician
João Carrilho · Assistant
Nuno Granjeiro · Assistant
Mário Aguiã · Assistant | Left in August

João Carlos Madureira · Assistant | Started in October

all from external company VERKO

Email · mschmidt@igc.gulbenkian.pt IGC Webpage · http://www.igc.gulbenkian.pt/facilities/maintenance



Staff in 2018

João Garcia · Systems Analyst

Mário Neto · Systems Administrator | Left in November **Fernando Azevedo** · Technician | Left in September

Manuel Carvalho · Technician Abisola Akinrinade · Developer

bit Ethernet to the desktop, campus-wide Wi-Fi, centralized file storage, internal helpdesk, knowledge base servers and fully integrated and automated intranet and user management.

Email · jsousa@igc.gulbenkian.pt IGC Webpage · http://www.igc.gulbenkian.pt/facilities/informatics

Library

Head | SOUSA, João

Description of Service

The IGC library is an open access, specialized library in biomedicine. Its bibliographic collection covers Biology, Biochemistry, Genetics, Pharmacology, Microbiology, Physiology, Immunology, Virology, Cell Biology, Neuroscience and Developmental Biology.

The library is intended for researchers, faculty and visiting scientists, students and staff of the IGC. It aims to provide access to useful, diversified and up to date information, to improve services provided, to acquire, register, maintain and distribute scientific information of interest to or produced by researchers and students who work at the IGC.

The IGC library has a collection of printed journals in the field of health sciences, which spans almost 30 years. Currently it subscribes a significant collection of international scientific journals in electronic version.



Staff in 2018

Jorge Carneiro · Scientific Coordinator | Left in March Isabel Gordo · Scientific Coordinator | Started in April Pedro Homem · Library Officer

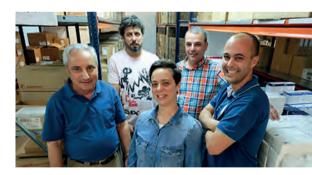
Email · jsousa@igc.gulbenkian.pt IGC Webpage · http://www.igc.gulbenkian.pt/facilities/library

Procurement Unit

Head | BRETANHA, António

Description of Service

This Service provides support for all IGC users on any Procurement topic from simple consumables ordering to complex contract negotiations with external suppliers. It is also responsible for IGC warehouse and internal logistic distribution.



Staff in 2018

Joana Gusmão · Procurement Officer Bruno Pinho · Procurement Officer Paulo Silva · Logistics

all from external company Flybridge

Abílio Simões · Stores Manager

Project Management

Head | SCHMIDT, Manuel | Started in April

Description of Service

This Service supports all research groups in all financial, administrative and fellowship topics related to their funded projects. The group is divided into International projects, National projects and Internal (FCG) projects.

Email · mschmidt@igc.gulbenkian.pt IGC Webpage · http://www.igc.gulbenkian.pt/facilities/adminunit



Staff in 2018

Tatiana Rocha · Admin Project Manager **André Sousa** · Admin Project Manager

Rita Gusmão · Admin Project Manager | Left in September

Ana Rita Batalha · from external company PwC

Ana Sofia Oliveira · from external company PwC

Scientific Events Management & Welcome

Head | MARTINS, Greta

Description of Service

This Service is responsible to organize all internal and external scientific Events of IGC including seminars, retreats, international workshops, etc. It has also the responsibility for travel bookings (flights & accommodation), for all IGC staff meeting rooms schedule management and supports incomers to IGC.

Email · gmartins@igc.gulbenkian.pt IGC Webpage · http://www.igc.gulbenkian.pt/facilities/adminunit



Staff in 2018

Rita Caré · Administrative | Started in October Regina Fernandes · Administrative | Started in September all from external company Flybridge

Anna Maria Fejfer · Meetings and Seminar Logistics Organisation | Left in October

News in 2018

The admin unit was restructured in October 2018 and split into smaller teams: Project Management, HR Assistance and ScientificEvents Management. We participated in the Euraxess national meeting at the FCT, Lisbon and in the COST Best Practice Training School in Belgrade.

In 2018 we provided logistics and admin support in part/or full time for:

- international and/or national meetings;
- > seminar and/or other scientific visitors to the IGC;
- new incoming researchers, including visas and social security.

Research Funding Affairs

Head | VIDAL, Sheila

Description of Service

The Research Funding Affairs Unit is responsible for the implementation of a pre-award grant administration service. Its main goal is to increase the IGC's capacity to attract competitive research funds launched by national, international, public and private grant programs. This service reports directly to the IGC Managing Deputy-Director, understands the different grant policies and requirements and works in collaboration with researchers, the Project Management Unit, the IGC Director and the three IGC Deputy-Directors. Services offered to the researchers include: identification and dissemination of funding opportunities tailored to the needs of the institute; support to the development and submission of grant proposals; post-award negotiation of grant agreements. The unit also organizes and lectures several informative sessions and workshops for grant application training of in-house and external researchers at all career stages. Finally, this unit also monitors the impact of the services offered through the quantification of several criteria.



Staff in 2018

Teresa Costa · Pre-Award Grants Advisor

News in 2018

During 2018, this service supported researchers in attracting several external competitive research funds. IGC researchers secured a total of 34 new external competitive research grants (33 FCT including 27 R&D research projects in all scientific domains as main proponent & 6 R&D research projects in all scientific domains as participating institution; 1 ERC Consolidator), 1 FCT CEEC Institutional working contract (Principal Investigator position for 6 years), 4 fellowships/contracts (4 Marie Curie Individual Fellowships), 3 prizes as well as 6 other type of funds, in a total amount of about 11 million EUR.

Publications

Agostinho, M., Moniz Alves, C., Aresta, S., Borrego,
 F., Borlido-Santos, J., Cortez, J., Costa. T. L., Lopes,
 J.A., Moreira, S., Santos, J., Trindade, M., Varela, C., &
 Vidal, S. (2018). The interface of science: the case for a broader definition of research management. *Perspectives: Policy and Practice in Higher Education*, 1–9. https://doi.org/10.1080/13603108.2018.1543215

Science Communication & Outreach

Head | MENA, Ana

Description of Service

The IGC runs a dedicated science communication and outreach programme, which actively engages IGC researchers, staff and PhD students in a dialogue with society. We aim at promoting the values of science, namely critical thinking, honesty and ethics, and openness to share and discuss new knowledge, encouraging public engagement in science. Our programme involves the media, students, teachers, general public, artists and policy makers.

News in 2018

Scientific achievements were disseminated via traditional and social media. The IGC organised a teacher training course, a job-shadowing programme and provided material for scientific activities in schools. Also, the IGC organised a general Open Day and an Open Day for University students, and participated in the International Immunology Day, NOS Alive music festival, European Researchers Night, and Science & Technology week. We conducted an exploratory project aimed at engaging socially-vulnerable communities in science. The complete list of activities can be found in the Public Engagement section.

Directorate Assistants

Description of Service

The team supports the Directors with all the administrative activities including meetings organization, scheduling, fellowships management, employees database management, support to Scientific and Ethics Committees, sabbatical visitors, among other tasks.



Staff in 2018

Joana Gonçalves-Sá · Scientific coordinator | Started in October

 $\textbf{Inês Domingues} \cdot \mathsf{Communications} \, \mathsf{Officer} \, | \, \mathsf{Left} \, \mathsf{in} \, \mathsf{May}$

Vanessa Borges · Public Engagement Officer Inês Bravo · Communications Officer

Cheila Almeida · Communications Assistant | Started in July,

left in August

Ana Matias · Masters Student | Started in June

Publications

> Caré, R., & Mena, A.L. (2018). Gaming and Animal Research: creating a video game script. In A. A. Carvalho, J. P. Pons, C. G. Marques, S. Cruz, A. Moura, I. L. Santos & D. Guimarães (Ed.), Atas do 4° Encontro sobre Jogos e Mobile Learning (pp. 94-101). Coimbra, Portugal: CEIS20. Retrieved from http://hdl.handle.net/10316/48542

Email · anamena@igc.gulbenkian.pt

 $\textcolor{red}{\textbf{IGC Webpage}} \cdot \texttt{http://www.igc.gulbenkian.pt/outreach}$



Staff in 2018

Liliana Rodrigues · Secretary to the Director
Olena Shydenko · Secretary to the Deputy Directors
Jorge Costa · Chauffeur (collaborator)

Technico-Scientific Support

Head | MORENO, Nuno

Description of Service

Our service supports facilities on a technical and managerial level, namely: homogenise the way internal accounting is made, develop tools to facilitate the communication to users and reporting, implementation of IOT (Internet Of Things) on the institute with over 250 sensors and actuators, running a seminar series dedicated to techniques and applications, development of experimental automation to minimize HR burdening. We also work tight together with procurement and facilities for equipment and other infrastructural related acquisition.



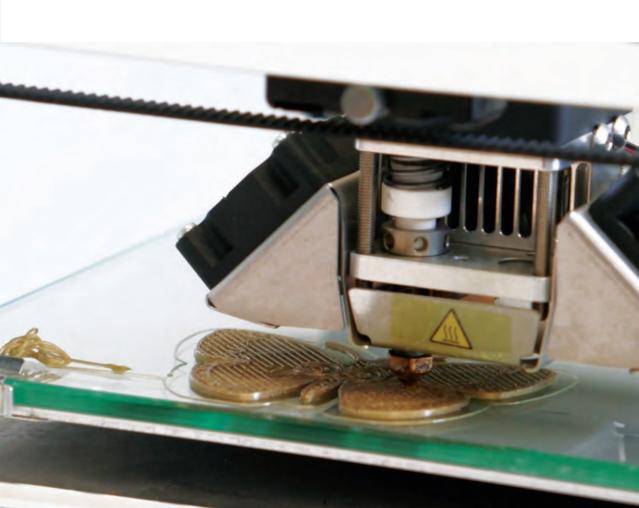
Staff in 2018

Ana Homem · Equipment repairs and orders

Tiago Vale · Hardware developer

Luís Oliveira · Masters student | Left in March

Email · moreno@igc.gulbenkian.pt IGC Webpage · http://www.igc.gulbenkian.pt/facilities/tss



Research Structures & Networks

Research Structures

UNIDADE DE INVESTIGAÇÃO - IGC

The Instituto Gulbenkian de Ciência (IGC) is an independent 'Research Unit' (Unidade de Investigação) rated as "Exceptional" under the international evaluation of Portuguese scientific research and technological development promoted by Fundação para a Ciência e a Tecnologia (FCT), in 2015. The scientific programme of the IGC Research Unit is dedicated to complex fundamental problems that fall largely into four research domains, namely quantitative biology, evolutionary biology, cell and developmental biology, and immunobiology. Modelling, quantitative biology and evolution are the conceptual substrate of the IGC, and influence thinking at the IGC in many ways. The Research Unit Team consists of 12 Research groups, each a cluster of 3 (or more) autonomous labs with sizes ranging from 3 to 15 lab members.

GREEN-IT

The GREEN–IT Research Unit addresses the challenge of ensuring food security for an evergrowing population, focusing on the impacts of climate change on crop production in the Mediterranean area. To this end, GREEN-IT also uses model systems such as *Arabidopsis thaliana* to advance basic knowledge on conserved mechanisms relevant to crops, and integrates the three plant research groups at the IGC. The Unit links five institutes ITQB, iBET, IGC, INIAV and INSA, creating a privileged environment and providing a unique set of conditions for career development of researchers working on plant sciences.

NATIONAL ROADMAP OF RESEARCH INFRA-STRUCTURES OF STRATEGIC RELEVANCE

Four research structures of the IGC are included in the National Roadmap of Research Infrastructures:

- BioData.pt: Portuguese Biological Data Network (coordinated by José Pereira-Leal, IGC)
- PPBI: Portuguese Platform of BioImaging (coordinated by Paula Sampaio, Instituto de Biologia Molecular e Celular)
- GenomePT: National Facility for Genome Sequencing and Analysis (coordinated by Manuel Santos, University of Aveiro)
- CONGENTO: Consortium of Genetically Tractable Organisms (coordinated by Rui Costa, Champalimaud Foundation).
- These research infrastructures are funded by the Programa Operacional Lisboa 2020 - FEEI (FEDER 2015-2020) and Fundação para a Ciência e a Tecnologia.

INFRAFRONTIER

Head of the Portuguese node: Jocelyne Demengeot

The laboratory mouse is the most important mammalian model for studying genetic and multi-factorial diseases in Man. Infrafrontier is the European Research Infrastructure for the development, phenotyping, archiving, and distribution of mammalian models. Infrafrontier draws on the expertise of 23 leading research institutes across 14 member states of the EU, including the IGC, in Portugal. The IGC offers a Germ-Free Service that generates, breeds and houses mice that are free of all microorganisms. These germ-free animals are crucial in studies aimed at understanding the effects of microorganisms on a host, or dissecting the molecular mechanisms underlying the function of the immune system. The facility, which has the capacity to temporarily host scientists wishing to carry out their own research with the mice at the IGC itself, has generated more than 20 different strains of germ-free mice, requested by researchers from several European countries.

BiodivERsA

Coordinator: Lounès Chikhi, IGC

BiodivERsA is a pan-European network coordinated by Lounès Chikhi at IGC that aims to promote research on biodiversity and ecosystem services, and offering innovative opportunities for the conservation and sustainable management of biodiversity. BiodivERsA is funded under the Horizon 2020 ERA—NET COFUND scheme.

EVOREPRO

Coordinator: Jörg Becker, IGC

EVOREPRO is a European and US consortium coordinated by Jörg Becker at IGC that aims to study the evolution of sexual reproduction in plants. The project is funded under the scope of ERA-CAPS, a European network dedicated to support research activities in Plant Sciences. This study will allow the identification of genes useful to the agricultural industry, with the aim of improving the reproduction of crop species, and ultimately to increase their yield.

Networks

EU-LIFE

EU-LIFE is an alliance that gathers thirteen renowned European research centres in life sciences: CRG-Barcelona (Spain); VIB (Belgium); Institut Curie (France); Max Delbrück Center for Molecular Medicine (Germany); Instituto Gulbenkian de Ciência (Portugal); CeMM (Austria); IEO (Italy); CEITEC (Czech Republic); NKI - Antoni van Leeuwenhoek (Netherlands); FIMM (Finland); BRIC (Denmark); Babraham Institute (UK); FMI (Switzerland). Partners in EU-LIFE operate with similar principles of excellence, external review, integrity and independence, competitiveness, internationality, and social responsibility. EU-LIFE partners believe that they can join forces to better address complex questions in research, training and research management, thereby contributing to pushing European science forward. Specific working groups join efforts, share best practice, brainstorm, and design common activities in areas of common interest such as technology transfer, international collaboration, translational research, science communication, competitive funding strategies, recruitment and training. EU-LIFE has been established as a voice for research institutes in European policy, currently participating in the two stakeholders'

platforms that advise regularly Commissioner Moedas and European Commission's DG RTD — the Open Science Policy Platform and the European Research Area Stakeholders' platform.

ELIXIR

Head of Train the Researcher: Pedro L. Fernandes, IGC

ELIXIR brings together life science resources from across Europe. These resources include databases. software tools, training materials, cloud storage and supercomputers. The goal of ELIXIR is to coordinate these resources so that they form a single infrastructure that makes it easier for scientists to find and share data, exchange expertise, and agree on best practices. Together with INESC-ID, ITQB and iBET, IGC is in the consortium that started ELIXIR Portugal and contributes actively to its Platforms. Moreover, IGC is a contractor in the H2020 EXCELERATE Project, that aims at accelerating the deployment of ELIXIR infrastructural services. Formed in 2017, BioData. pt, a national bioinformatics network focused on adding value to biological information, started to operate as the national node of ELIXIR.

BioData.pt

CEO: Ana Portugal Melo, IGC

Training Coordinator: Pedro L. Fernandes, IGC

IGC is the host institution that heads the implementation of BioData.pt, the national infrastructure for biological data. It supports the national scientific system through best practices in data management and state of the art data analysis. This national infrastructure interfaces with both academia and industry, making research available for innovation, namely in sectors such as agrofood and forestry, sea, and health. The BioData. pt infrastructure has incorporated the Portuguese node of ELIXIR and all its activities and members. The infrastructure offers a variety of services, announced on its website, that include training programmes, computing facilities, consulting services in data analysis and management, among others.

GOBLET

IGC representative, Chair of the LET Committee: Pedro L. Fernandes

GOBLET, the Global Organisation for Bioinformatics Learning, Education and Training, is a focused group that dedicates systematic efforts to develop and enhance Bioinformatics Training and Education methods, sharing best practice in teaching and learning methods and supporting bioinformatics trainers and teachers worldwide. The IGC is a member of GOBLET since its inception in 2012.

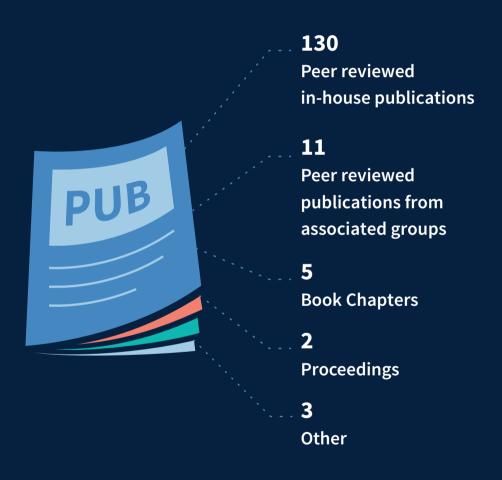
NEUBIAS

IGC representative: Gabriel G. Martins (WG2 leader); Nuno P. Martins (co-organiser of NEUBIAS school in Sweden)

NEUBIAS is a Network of European BioImage Analysts which aims to advance life science imaging, maximize impact of imaging technology and boost productivity of bioimaging-based research projects in Europe. NEUBIAS collaborates with EU imaging research infrastructures to set up best practice guidelines for image analysis. The Action is creating interactive databases for tools and workflows with annotated image sample datasets, to help matching practical needs in biological problems with software solutions, and to benchmark these tools. NEUBIAS also developed a novel training programme with three levels of schools, open textbooks and offers travel grants in a Short Term Scientific Missions programme to foster collaborations, technology access and knowledge transfer for scientists and specialists.







PUBLICATIONS

Peer-reviewed Publications 2018

In-House Publications

- 1. Adrain, C., Henis-Korenblit, S., & Domingos, P. M. (2018). Meeting Report proteostasis in Ericeira. *Journal of Cell Science*, 131(5), jcs216150. https://doi.org/10.1242/jcs.216150
- 2. Agostinho, M., Moniz Alves, C., Aresta, S., Borrego, F., Borlido-Santos, J., Cortez, J., Costa. T. L., Lopes, J.A., Moreira, S., Santos, J., Trindade, M., Varela, C., & Vidal, S. (2018). The interface of science: the case for a broader definition of research management. *Perspectives: Policy and Practice in Higher Education*, 1–9. https://doi.org/10.1080/13603108.2018.1543215
- 3. Agua-Doce, A., Caridade, M., Oliveira, V. G., Bergman, L., Lafaille, M. C., Lafaille, J. J., Demengeot, J., & Graca, L. (2018). Route of Antigen Presentation Can Determine the Selection of Foxp3-Dependent or Foxp3-Independent Dominant Immune Tolerance. *The Journal of Immunology, 200*(1), 101–109. https://doi.org/10.4049/jimmunol.1601886
- 4. Aires, R., Dias, A., & Mallo, M. (2018). Deconstructing the molecular mechanisms shaping the vertebrate body plan. *Current Opinion in Cell Biology*, 55, 81–86. https://doi.org/10.1016/j.ceb.2018.05.009
- 5. Aleixo-Pais, I., Salmona, J., Sgarlata, G. M., Rakotonanahary, A., Sousa, A. P., Parreira, B., Kun-Rodrigues, C., Ralantoharijaona, T., Jan, F., Rasolondraibe, E., Minhós, T., Zaonarivelo, J. R., Andriaholinirina, N. V., & Chikhi, L. (2018). The genetic structure of a mouse lemur living in a fragmented habitat in Northern Madagascar. Conservation Genetics. https://doi.org/10.1007/s10592-018-1126-z
- 6. Alenquer, M., Vale-Costa, S., Sousa, A. L., Etibor, T. A., Ferreira, F., & Amorim, M. J. (2018). Influenza a virus ribonucleoproteins form liquid

- organelles at endoplasmic reticulum exit sites. *BioRxiv*. https://doi.org/10.1101/410373
- 7. Anania, A., Salmona, J., Rasolondraibe, E., Jan, F., Chikhi, L., Fichtel, C., Kappeler, P. M., & Rasoloarison, R. (2018). Taboo adherence and presence of Perrier's sifaka (*Propithecus perrieri*) in Andrafiamena forest. *Madagascar Conservation & Development*, 13(1). https://doi.org/10.4314/mcd.v13i1.1
- 8. Balogun, W. G., Cobham, A. E., Amin, A., & Seeni, A. (2018a). Advancing Neuroscience Research in Africa: Invertebrate Species to the Rescue. *Neuroscience*, 374, 323–325. https://doi.org/10.1016/j.neuroscience.2018.01.062
- 9. Balogun, W. G., Cobham, A. E., Amin, A., & Seeni, A. (2018b). Using invertebrate model organisms for neuroscience research and training: an opportunity for Africa. *Metabolic Brain Disease*, 33(5), 1431–1441. https://doi.org/10.1007/s11011-018-0250-2
- 10. Bambouskova, M., Gorvel, L., Lampropoulou, V., Sergushichev, A., Loginicheva, E., Johnson, K., Korenfeld, D., Mathyer, M. E., Kim, H., Huang, L., Duncan., D., Bregman, H., Keskin, A., Santeford, A., Apte, R. A., Sehgal, R., Johnson, B., Amarasinghe, G. K., Soares, M. P., Satoh, T., Akira, S., Hai, T., Strong, C. G., Auclair, K., Roddy, T. P., Biller, S. A., Jovanovic, M., Klechevsky, E., Stewart, K. M., Randolph, G. J., & Artyomov, M. N. (2018). Electrophilic properties of itaconate and derivatives regulate the IkBζ-ATF3 inflammatory axis. *Nature*, 556(7702), 501–504. https://doi.org/10.1038/s41586-018-0052-z
- 11. Baptista, B. J. A., Granato, A., Canto, F. B., Montalvão, F., Tostes, L., de Matos Guedes, H. L., Coutinho, A., Bellio, M., Vale, A. M., & Nobrega, A. (2018). TLR9 Signaling Suppresses the Canonical Plasma Cell Differentiation Program in Follicular B Cells. Frontiers in Immunology, 9. https://doi.org/10.3389/fimmu.2018.02281

- 12. Blanckaert, A., & Bank, C. (2018). In search of the Goldilocks zone for hybrid speciation. *PLOS Genetics*, 14(9), e1007613. https://doi.org/10.1371/journal.pgen.1007613
- 13. Blanckaert, A., & Hermisson, J. (2018). The Limits to Parapatric Speciation II: Strengthening a Preexisting Genetic Barrier to Gene Flow in Parapatry. *Genetics*, 209(1), 241–254. https://doi.org/10.1534/genetics.117.300652
- 14. Brito, P. H., Chevreux, B., Serra, C. R., Schyns, G., Henriques, A. O., & Pereira-Leal, J. B. (2018). Genetic Competence Drives Genome Diversity in Bacillus subtilis. *Genome Biology and Evolution*, 10(1), 108–124. https://doi.org/10.1093/gbe/evx270
- 15. Cabral, V., & Xavier, K. B. (2018). Bacterial Call to Arms for Warfare at the Infection Site. *Cell Host & Microbe*, 23(3), 285–287. https://doi.org/10.1016/j.chom.2018.02.009
- 16. Campinho, M. A., Silva, N., Martins, G. G., Anjos, L., Florindo, C., Roman-Padilla, J., Garcia-Cegarra, A., Louro, B., Manchado, M., & Power, D. M. (2018). A thyroid hormone regulated asymmetric responsive centre is correlated with eye migration during flatfish metamorphosis. *Scientific Reports*, 8(1). https://doi.org/10.1038/s41598-018-29957-8
- 17. Carbonetto, B., Ramsayer, J., Nidelet, T., Legrand, J., & Sicard, D. (2018). Bakery yeasts, a new model for studies in ecology and evolution. *Yeast*, 35(11), 591–603. https://doi.org/10.1002/yea.3350
- 18. Cardoso, S. D., Gonçalves, D., Goesmann, A., Canário, A. V. M., & Oliveira, R. F. (2018). Temporal variation in brain transcriptome is associated with the expression of female mimicry as a sequential male alternative reproductive tactic in fish. *Molecular Ecology*, 27(3), 789–803. https://doi.org/10.1111/mec.14408
- 19. Carlos, A. R., Weis, S., & Soares, M. P. (2018). Cross-Talk Between Iron and Glucose Metabolism in the Establishment of Disease Tolerance. Frontiers in Immunology, 9. https://doi.org/10.3389/fimmu.2018.02498
- 20. Carvalhal, S., Tavares, A., Santos, M. B., Mirkovic, M., & Oliveira, R. A. (2018). A quantitative analysis of cohesin decay in mitotic fidelity. *The Journal of Cell Biology*, 217(10), 3343–3353. https://doi.org/10.1083/jcb.201801111
- 21. Casaca, A., Hauswirth, G. M., Bildsoe, H.,

- Mallo, M., & McGlinn, E. (2018). Regulatory landscape of the Hox transcriptome. *The International Journal of Developmental Biology*, 62(11–12), 693–704. https://doi.org/10.1387/ijdb.180270em
- 22. Chikhi, L., Rodríguez, W., Grusea, S., Santos, P., Boitard, S., & Mazet, O. (2018). The IICR (inverse instantaneous coalescence rate) as a summary of genomic diversity: insights into demographic inference and model choice. *Heredity*, 120(1), 13–24. https://doi.org/10.1038/s41437-017-0005-6
- 23. Chrostek, E., & Teixeira, L. (2018). Within host selection for faster replicating bacterial symbionts. *PLOS ONE*, 13(1), e0191530. https://doi.org/10.1371/journal.pone.0191530
- 24. Coll, F., Phelan, J., Hill-Cawthorne, G. A., Nair, M. B., Mallard, K., Ali, S., Abdallah, A. M., Alghamdi, S., Alsomali, M., Ahmed, A. O., Portelli, S., Oppong, Y., Alves, A., Bessa, T. B., Campino, S., Caws, M., Chatterjee, A., Crampin, A. C., Dheda, K., Furnham, N., Glynn, J. R., Grandjean, L., Minh Ha, D., Hasan, R., Hasan, Z., Hibberd, M. L., Joloba, M., Jones-López, E. C., Matsumoto, T., Miranda, A., Moore, D. J., Mocillo, N., Panaiotov, S., Parkhill, J., Penha-Goncalves, C., Perdigão, J., Portugal, I., Rchiad, Z., Robledo, J., Sheen, P., Shesha, N. T., Sirgel, F. A., Sola, C., Sousa, E. O., Streicher, E. M., Helden, P. V., Viveiros, M., Warren, R. M., McNerney, R., Pain, A., & Clark, T. G. (2018). Genome-wide analysis of multi- and extensively drug-resistant Mycobacterium tuberculosis. Nature Genetics, 50(5), 764-764, https:// doi.org/10.1038/s41588-017-0029-0
- 25. Correia, R. B., de Araújo, L. P., Mattos, M. M., & Rocha, L. M. (2018). City-wide Analysis of Electronic Health Records Reveals Gender and Age Biases in the Administration of Known Drug-Drug Interactions. ArXiv:1803.03571 [Cs, q-Bio, Stat]. Retrieved from http://arxiv.org/abs/1803.03571
- 26. Correia, R. B., Gates, A. J., Wang, X., & Rocha, L. M. (2018). CANA: A Python Package for Quantifying Control and Canalization in Boolean Networks. *Frontiers in Physiology*, 9. https://doi.org/10.3389/fphys.2018.01046
- 27. 28. Cortez, M. M., Rojas, G. C., & Parkhouse, R. M. E. (2018). The HP10 Taenia monoclonal antibody-based ELISA detects a similar protein in the vesicular fluid of Taenia hydatigena. *Tropical Animal Health and Production*, 50(3), 697–700. https://doi.org/10.1007/s11250-017-1473-7

- 28. Costa, R. M., Oliveira, G., Pestana, J., Costa, D., & Oliveira, R. F. (2018). Do psychosocial factors moderate the relation between testosterone and female sexual desire? The role of interoception, alexithymia, defense mechanisms, and relationship status. *Adaptive Human Behavior and Physiology* 1-18. https://doi.org/10.1007/s40750-018-0102-7
- 29. de Lemos, L., Junyent, F., Camins, A., Castro-Torres, R. D., Folch, J., Olloquequi, J., Beas-Zarate, C., Verdaguer, E., & Auladell, C. (2018). Neuroprotective Effects of the Absence of JNK1 or JNK3 Isoforms on Kainic Acid-Induced Temporal Lobe Epilepsy-Like Symptoms. *Molecular Neurobiology*, 55, 4437-4452. https://doi.org/10.1007/s12035-017-0669-1
- 30. de Moraes, L. V., Barateiro, A., Sousa, P. M., & Penha-Gonçalves, C. (2018). Bradykinin Sequestration by Plasmodium berghei Infected Erythrocytes Conditions B2R Signaling and Parasite Uptake by Fetal Trophoblasts. Frontiers in Microbiology, 9. https://doi.org/10.3389/fmicb.2018.03106
- **31.** de Visser, J. A. G. M., Elena, S. F., Fragata, I., & Matuszewski, S. (2018). The utility of fitness landscapes and big data for predicting evolution. *Heredity*, 121(5), 401–405. https://doi.org/10.1038/s41437-018-0128-4
- 32. Dias-Santos, A., Proença, R. P., Tavares Ferreira, J., Pinheiro, S., Cunha, J. P., Proença, R., & Moraes-Fontes, M. F. (2018). The role of ophthalmic imaging in central nervous system degeneration in systemic lupus erythematosus. *Autoimmunity Reviews*, 17(6), 617–624. https://doi.org/10.1016/j.autrev.2018.01.011
- 33. Duarte, N., Coelho, I., Holovanchuk, D., Inês Almeida, J., Penha-Gonçalves, C., & Paula Macedo, M. (2018). Dipeptidyl Peptidase-4 Is a Pro-Recovery Mediator During Acute Hepatotoxic Damage and Mirrors Severe Shifts in Kupffer Cells. *Hepatology Communications*, 2(9), 1080–1094. https://doi.org/10.1002/hep4.1225
- 34. Durão, P., Balbontín, R., & Gordo, I. (2018). Evolutionary Mechanisms Shaping the Maintenance of Antibiotic Resistance. *Trends in Microbiology*, 26(8), 677–691. https://doi.org/10.1016/j.tim.2018.01.005
- 35. Durão, V., Silva, A., Macedo, R., Durão, P., Santos-Silva, A., & Duarte, R. (2018). Portuguese in vitro antibiotic susceptibilities favor current nontuberculous mycobacteria treatment guide-

- lines. Pulmonology. https://doi.org/10.1016/j.pulmoe.2018.09.001
- **36.** Fabian, D. K., Garschall, K., Klepsatel, P., Santos-Matos, G., Sucena, É., Kapun, M., Lemaitre, B., Schlötterer, C., Arking, R., & Flatt, T. (2018). Evolution of longevity improves immunity in *Drosophila*. *Evolution Letters*, *2*(6), 567–579. https://doi.org/10.1002/evl3.89
- 37. Fan, G., Chan, J., Ma, K., Yang, B., Zhang, H., Yang, X., Shi, C., Law, H. C., Ren, Z., Xu, Q., Liu, Q., Wang, J., Chen. W., Shao, L., Gonçalves, D., Ramos, A., Cardoso, S. D., Guo, M., Cai, J., Xu, X., Wang, J., Yang, H., Liu, X., & Wang, Y. (2018). Chromosome-level reference genome of the Siamese fighting fish Betta splendens, a model species for the study of aggression. *GigaScience*. https://doi.org/10.1093/gigascience/giy087
- 38. Faria, D., Pesquita, C., Mott, I., Martins, C., Couto, F. M., & Cruz, I. F. (2018). Tackling the challenges of matching biomedical ontologies. *Journal of Biomedical Semantics*, 9(1). https://doi.org/10.1186/s13326-017-0170-9
- **39.** Faria, G. S., Varela, S. A. M., & Gardner, A. (2018). The relation between R. A. Fisher's sexyson hypothesis and W. D. Hamilton's greenbeard effect. *Evolution Letters*, *2*(3), 190–200. https://doi.org/10.1002/evl3.53
- 40. Faria, V. G., Martins, N. E., Schlötterer, C., & Sucena, É. (2018). Readapting to DCV Infection without Wolbachia: Frequency Changes of Drosophila Antiviral Alleles Can Replace Endosymbiont Protection. Genome Biology and Evolution, 10(7), 1783-1791. https://doi.org/10.1093/gbe/evy137
- 41. Ferrari, C., Proost, S., Janowski, M., Becker, J., Nikoloski, Z., Bhattacharya, D., Price, D., Tohge, T., Bar-Even, A., Fernie, A., Stitt, M., & Mutwil, M. (2018). Kingdom-wide comparison reveals conserved diurnal gene expression in Archaeplastida. *BioRxiv*. https://doi.org/10.1101/387316
- 42. Ferreira da Silva, M. J., Kopp, G. H., Casanova, C., Godinho, R., Minhós, T., Sá, R., Zinner, D., & Bruford, M. W. (2018). Disrupted dispersal and its genetic consequences: Comparing protected and threatened baboon populations (*Papio papio*) in West Africa. *PLOS ONE*, 13(4), e0194189. https://doi.org/10.1371/journal.pone.0194189
- 43. Fragata, I., Matuszewski, S., Schmitz, M. A., Bataillon, T., Jensen, J. D., & Bank, C. (2018). The

- fitness landscape of the codon space across environments. $Heredity,\ 121(5),\ 422-437.$ https://doi.org/10.1038/s41437-018-0125-7
- 44. Fragata, I., Simões, P., Matos, M., Szathmáry, E., & Santos, M. (2018). Playing evolution in the laboratory: From the first major evolutionary transition to global warming. *EPL (Europhysics Letters)*, 122(3), 38001. https://doi.org/10.1209/0295-5075/122/38001
- 45. Ghenu, A.-H., Blanckaert, A., Butlin, R. K., Kulmuni, J., & Bank, C. (2018). Conflict between heterozygote advantage and hybrid incompatibility in haplodiploids (and sex chromosomes). *Molecular Ecology*, 27(19), 3935–3949. https://doi.org/10.1111/mec.14482
- 46. Gil, F. N., Gonçalves, A. C., Becker, J. D., & Viegas, C. A. (2018). Comparative analysis of transcriptomic responses to sub-lethal levels of six environmentally relevant pesticides in Saccharomyces cerevisiae. *Ecotoxicology*, 27(7), 871–889. https://doi.org/10.1007/s10646-018-1929-1
- 47. Gordon, O., Henry, C. M., Srinivasan, N., Ahrens, S., Franz, A., Deddouche, S., Chakravarty, P., Phillips, D., George, R., Kjaer, S., Frith, D., Snijders, A. P., Valente, R. S., Simoes da Silva, C. J., Teixeira, L., Thompson, B., Dionne, M. S., Wood, W., & Reis e Sousa, C. (2018). α-actinin accounts for the bioactivity of actin preparations in inducing STAT target genes in *Drosophila melanogaster*. *ELife*, 7. https://doi.org/10.7554/eLife.38636
- 48. Gorgulho, R., Jacinto, R., Lopes, S. S., Pereira, S. A., Tranfield, E. M., Martins, G. G., Gualda, E.J., Derks, R. J. E., Correia, A. C., Steenvoorden, E., Pintado, P., Mayboroda, O. A., Monteiro. E. C., & Morello, J. (2018). Usefulness of zebrafish larvae to evaluate drug-induced functional and morphological renal tubular alterations. *Archives of Toxicology*, 92(1), 411–423. https://doi.org/10.1007/s00204-017-2063-1
- 49. Grusea, S., Rodríguez, W., Pinchon, D., Chikhi, L., Boitard, S., & Mazet, O. (2018). Coalescence times for three genes provide sufficient information to distinguish population structure from population size changes. *Journal of Mathematical Biology*. https://doi.org/10.1007/s00285-018-1272-4
- 50. Guzella, T. S., Dey, S., Chelo, I. M., Pino-Querido, A., Pereira, V. F., Proulx, S. R., & Teotónio, H. (2018). Slower environmental change hinders adaptation from standing genetic varia-

- tion. PLOS Genetics, 14(11), e1007731. https://doi.org/10.1371/journal.pgen.1007731
- 51. Henstridge, M. A., Aulsebrook, L., Koyama, T., Johnson, T. K., Whisstock, J. C., Tiganis, T., Mirth, C. K., & Warr, C. G. (2018). Torso-Like Is a Component of the Hemolymph and Regulates the Insulin Signaling Pathway in. *Genetics*, 208(4), 1523–1533. https://doi.org/10.1534/genetics.117.300601
- 52. Horn, R. L., Marques, A. J. D., Manseau, M., Golding, B., Klütsch, C. F. C., Abraham, K., & Wilson, P. J. (2018). Parallel evolution of site-specific changes in divergent caribou lineages. *Ecology and Evolution*, 8(12), 6053–6064. https://doi.org/10.1002/ece3.4154
- 53. Ito, D., & Bettencourt-Dias, M. (2018). Centrosome Remodelling in *Evolution*. *Cells*, 7(7), 71. https://doi.org/10.3390/cells7070071
- 54. Jana, S. C., Mendonça, S., Machado, P., Werner, S., Rocha, J., Pereira, A., Maiato, H., & Bettencourt-Dias, M. (2018). Differential regulation of transition zone and centriole proteins contributes to ciliary base diversity. *Nature Cell Biology*, 20(8), 928–941. https://doi.org/10.1038/s41556-018-0132-1
- 55. Janody, F. (2018). The Big Bang of tissue growth: Apical cell constriction turns into tissue expansion. *The Journal of Cell Biology*, 217(3), 807–808. https://doi.org/10.1083/jcb.201801076
- 56. Keppner, L., Heinrichs, M., Rieckmann, M., Demengeot, J., Frantz, S., Hofmann, U., & Ramos, G. (2018). Antibodies aggravate the development of ischemic heart failure. *American Journal of Physiology-Heart and Circulatory Physiology*, 315(5), H1358–H1367. https://doi.org/10.1152/ajpheart.00144.2018
- 57. King, J. G., Souto-Maior, C., Sartori, L. M., Maciel-de-Freitas, R., & Gomes, M. G. M. (2018). Variation in Wolbachia effects on Aedes mosquitoes as a determinant of invasiveness and vectorial capacity. *Nature Communications*, 9(1). https://doi.org/10.1038/s41467-018-03981-8
- **58.** Knoop, S., Chikhi, L., & Salmona, J. (2018). Mouse lemurs' use of degraded habitat: a review of the literature. In *Lemur News* (Vol. 21, pp. 20–31). Retrieved from http://www.aeecl.org/lemurnews/lemurnews2018_21.pdf
- 59. Koyama, T., & Mirth, C. K. (2018). Unravelling the diversity of mechanisms through which nutrition regulates body size in insects.

- Current Opinion in Insect Science, 25, 1–8. https://doi.org/10.1016/j.cois.2017.11.002
- 60. Lafuente, E., Duneau, D., & Beldade, P. (2018). Genetic basis of thermal plasticity variation in *Drosophila melanogaster* body size. *PLOS Genetics*, 14(9), e1007686. https://doi.org/10.1371/journal.pgen.1007686
- 61. Laloum, T., Martín, G., & Duque, P. (2018). Alternative Splicing Control of Abiotic Stress Responses. *Trends in Plant Science*, 23(2), 140–150. https://doi.org/10.1016/j.tplants.2017.09.019
- 62. Loncarek, J., & Bettencourt-Dias, M. (2018). Building the right centriole for each cell type. *The Journal of Cell Biology*, 217(3), 823–835. https://doi.org/10.1083/jcb.201704093
- 63. Lopes, C. A. M., Mesquita, M., Cunha, A. I., Cardoso, J., Carapeta, S., Laranjeira, C., Pinto, A. E., Pereira-Leal, J. B., Dias-Pereira, A., Bettencourt-Dias, M., & Chaves, P. (2018). Centrosome amplification arises before neoplasia and increases upon p53 loss in tumorigenesis. *The Journal of Cell Biology*, 217(7), 2353–2363. https://doi.org/10.1083/jcb.201711191
- 64. Macedo, J. C., Vaz, S., Bakker, B., Ribeiro, R., Bakker, P. L., Escandell, J. M., Ferreira, M. G., Medema, R., Foijer, F., & Logarinho, E. (2018). FoxM1 repression during human aging leads to mitotic decline and aneuploidy-driven full senescence. *Nature Communications*, 9(1). https://doi.org/10.1038/s41467-018-05258-6
- 65. Mallo, M. (2018). Reassessing the Role of Hox Genes during Vertebrate Development and Evolution. *Trends in Genetics*, 34(3), 209–217. https://doi.org/10.1016/j.tig.2017.11.007
- 66. Marteil, G., Guerrero, A., Vieira, A. F., de Almeida, B. P., Machado, P., Mendonça, S., Mesquita, M., Villarreal, B., Fonseca, I., Francia, M.E., Dores, K., Martins, N.P., Jana, S. C., Tranfield, E. M., Barbosa-Morais, N. L., Paredes, J., Pellman, D., Godinho, S. A., & Bettencourt-Dias, M. (2018). Over-elongation of centrioles in cancer promotes centriole amplification and chromosome missegregation. *Nature Communications*, 9(1). https://doi.org/10.1038/s41467-018-03641-x
- 67. Martins, R., & Knapp, S. (2018). Heme and hemolysis in innate immunity: adding insult to injury. *Current Opinion in Immunology*, *50*, 14–20. https://doi.org/10.1016/j.coi.2017.10.005
- 68. Martins, T., Valentim, A., Pereira, N., & Antunes, L. M. (2018). Anaesthetics and anal-

- gesics used in adult fish for research: A review. Laboratory Animals, 002367721881519. https://doi.org/10.1177/0023677218815199
- 69. Matmati, S., Vaurs, M., Escandell, J. M., Maestroni, L., Nakamura, T. M., Ferreira, M. G., Géli, V., & Coulon, S. (2018). The fission yeast Stn1-Ten1 complex limits telomerase activity via its SUMO-interacting motif and promotes telomeres replication. *Science Advances*, 4(5), eaar2740. https://doi.org/10.1126/sciadv.aar2740
- 70. Mendes, N. D., Henriques, R., Remy, E., Carneiro, J., Monteiro, P. T., & Chaouiya, C. (2018). Estimating Attractor Reachability in Asynchronous Logical Models. Frontiers in Physiology, 9. https://doi.org/10.3389/fphys.2018.01161
- 71. Miller, A., Mills, H., Ralantoharijaona, T., Volasoa, N. A., Misandeau, C., Chikhi, L., Bencini, R., & Salmona, J. (2018). Forest Type Influences Population Densities of Nocturnal Lemurs in Manompana, Northeastern Madagascar. *International Journal of Primatology*, 39(4), 646–669. https://doi.org/10.1007/s10764-018-0055-5
- 72. Mirkovic, M., Guilgur, L. G., Passagem-Santos, D., & Oliveira, R. A. (2018). Delayed aneuploidy stress response of neural stem cells impairs adult lifespan in flies. *BioRxiv*. https://doi.org/10.1101/392746
- 73. Moraes-Fontes, M. F., Caramalho, Í., Hsu, A. P., Holland, S. M., & Abecasis, M. (2018). MonoMAC Syndrome Caused by a Novel GATA2 Mutation Successfully Treated by Allogeneic Hematopoietic Stem Cell Transplantation. *Journal of Clinical Immunology*. https://doi.org/10.1007/s10875-018-0576-x
- 74. Naldi, A., Hernandez, C., Abou-Jaoudé, W., Monteiro, P. T., Chaouiya, C., & Thieffry, D. (2018). Logical Modeling and Analysis of Cellular Regulatory Networks With GINsim 3.0. Frontiers in Physiology, 9. https://doi.org/10.3389/fphys.2018.00646
- 75. Naldi, A., Hernandez, C., Levy, N., Stoll, G., Monteiro, P. T., Chaouiya, C., Helikar, T., Zinovyev, A., Calzone, L., Cohen-Boulakia, S., Thieffry, D., & Paulevé, L. (2018). The CoLoMoTo Interactive Notebook: Accessible and Reproducible Computational Analyses for Qualitative Biological Networks. *BioRxiv*. https://doi.org/10.1101/290411
- 76. Navarro-Costa, P. (2018). A (micro)environmental perspective on the evolution of fe-

- male reproductive aging. *Journal of Assisted Reproduction and Genetics*, 35(12), 2129–2131. https://doi.org/10.1007/s10815-018-1355-6
- 77. Nokelainen, O., van Bergen, E., Ripley, B. S., & Brakefield, P. M. (2018). Adaptation of a tropical butterfly to a temperate climate. *Biological Journal of the Linnean Society*, 123(2), 279–289. https://doi.org/10.1093/biolinnean/blx145
- 78. Núñez, G., Sakamoto, K., & Soares, M. P. (2018). Innate Nutritional Immunity. *The Journal of Immunology*, 201(1), 11–18. https://doi.org/10.4049/jimmunol.1800325
- 79. Oikonomidi, I., Burbridge, E., Cavadas, M., Sullivan, G., Collis, B., Naegele, H., Clancy, D., Brezinova, J., Hu, T., Bileck, A., Gerner, C., Bolado, A., von Kriegsheim, A. Martin, S. M., Steinberg, F., Strisovsky, K., & Adrain, C. (2018). iTAP, a novel iRhom interactor, controls TNF secretion by policing the stability of iRhom/TACE. *ELife*, 7. https://doi.org/10.7554/eLife.35032
- 80. Oliveira, A. L., Ruano, C., Riso, N., Cepeda Ribeiro, J., & Moraes-Fontes, M. F. (2018). Paradoxical pulmonary event under tocilizumab treatment for systemic sclerosis-associated usual interstitial pneumonia. *Annals of the Rheumatic Diseases*, annrheumdis–2018–214747. https://doi.org/10.1136/annrheumdis-2018-214747
- 81. Ouma-Mugabe, J., Chaminuka, P., & Melo, A. M. P. (2018). Characterising partnership for research and innovation in Sub-Saharan Africa: Lessons from the case of the Africa–EU ProIntensAfrica Initiative. South African Journal of International Affairs, 25(4), 531–545. https://doi.org/10.1080/10220461.2018.1551152
- 82. Özkaya, Ö., Balbontín, R., Gordo, I., & Xavier, K. B. (2018). Cheating on Cheaters Stabilizes Cooperation in Pseudomonas aeruginosa. *Current Biology*, 28(13), 2070–2080.e6. https://doi.org/10.1016/j.cub.2018.04.093
- 83. Pais, I. S., Valente, R. S., Sporniak, M., & Teixeira, L. (2018). *Drosophila melanogaster* establishes a species-specific mutualistic interaction with stable gut-colonizing bacteria. *PLOS Biology*, 16(7), e2005710. https://doi.org/10.1371/journal.pbio.2005710
- 84. Paiva, R. A., Ramos, C. V., & Martins, V. C. (2018). Thymus autonomy as a prelude to leukemia. *The FEBS Journal*, 285(24), 4565–4574. https://doi.org/10.1111/febs.14651

- 85. Parkhouse, R. M. E., Carpio, A., Campoverde, A., Sastre, P., Rojas, G., & Cortez, M. M. (2018). Reciprocal contribution of clinical studies and the HP10 antigen ELISA for the diagnosis of extraparenchymal neurocysticercosis. *Acta Tropica*, 178, 119–123. https://doi.org/10.1016/j.actatropica.2017.11.005
- 86. Parkhouse, R. M. E., Carpio, A., Campoverde, A., Sastre, P., Rojas, G., Harrison, L. J. S., & Cortez, M. M. (2018). A modified lateral flow assay, using serum, for the rapid identification of human and bovine cysticercosis in the absence of false positives. Transactions of The Royal Society of Tropical Medicine and Hygiene. https://doi.org/10.1093/trstmh/try116
- 87. Passagem-Santos, D., Zacarias, S., & Perfeito, L. (2018). Power law fitness landscapes and their ability to predict fitness. *Heredity*, 121(5), 482–498. https://doi.org/10.1038/s41437-018-0143-5
- 88. Pedersen, C.-E. T., Albrechtsen, A., Etter, P. D., Johnson, E. A., Orlando, L., Chikhi, L., Siegismund, H. R., & Heller, R. (2018). A southern African origin and cryptic structure in the highly mobile plains zebra. *Nature Ecology & Evolution*, 2(3), 491–498. https://doi.org/10.1038/s41559-017-0453-7
- 89. Pedrotti, L., Weiste, C., Nägele, T., Wolf, E., Lorenzin, F., Dietrich, K., Dietrich, K., Mair, A., Weckwerth, W., Teige, M., Baena-González, E. & Dröge-Laser, W. (2018). Snf1-RELATED KINASE1-Controlled C/S -bZIP Signaling Activates Alternative Mitochondrial Metabolic Pathways to Ensure Plant Survival in Extended Darkness. *The Plant Cell*, 30(2), 495–509. https://doi.org/10.1105/tpc.17.00414
- 90. Pereira, C. F., Wise, H. M., Kurian, D., Pinto, R. M., Amorim, M. J., Gill, A. C., & Digard, P. (2018). Effects of mutations in the effector domain of influenza A virus NS1 protein. *BMC Research Notes*, 11(1). https://doi.org/10.1186/s13104-018-3779-6
- 91. Pérez-Wohlfeil, E., Torreno, O., Bellis, L. J., Fernandes, P. L., Leskosek, B., & Trelles, O. (2018). Training bioinformaticians in High Performance Computing. *Heliyon*, 4(12), e01057. https://doi.org/10.1016/j.heliyon.2018.e01057
- 92. Pestana J., Menéres S., Gouveia M. J., & Oliveira R. F. (2018). The reading the mind in the eyes test: a portuguese version of the adults' test.

- Análise Psicológica, 3(XXXVI), 369-381. Retrieved from http://hdl.handle.net/10400.12/6718
- 93. Pirzgalska, R. M., & Domingos, A. I. (2018). Macrophages in obesity. *Cellular Immunology*, 330, 183–187. https://doi.org/10.1016/j.cellimm.2018.04.014
- 94. Priego-Espinosa, D. A., Darszon, A., Guerrero, A., González-Cota, A. L., Nishigaki, T., Martínez-Mekler, G., & Carneiro, J. (2018). Modular mathematical analysis of the control of flagellar Ca²+-spike trains produced by CatSper and Ca_v channels in sea urchin sperm. *BioRxiv*. https://doi.org/10.1101/415687
- 95. Prudêncio, P., Guilgur, L. G., Sobral, J., Becker, J. D., Martinho, R. G., & Navarro-Costa, P. (2018). The Trithorax group protein dMLL3/4 instructs the assembly of the zygotic genome at fertilization. *EMBO Reports*, 19(8), e45728. https://doi.org/10.15252/embr.201845728
- 96. Reddy, V. P., Chinta, K. C., Saini, V., Glasgow, J. N., Hull, T. D., Traylor, A., Rey-Stolle, F., Soares, M. P., Madansein, R., Rahman, M. A., Barbas, C., Nargan, K., Naidoo, T., Ramdial, P. K., George, J. F., Agarwal, A., & Steyn, A. J. C. (2018). Ferritin H Deficiency in Myeloid Compartments Dysregulates Host Energy Metabolism and Increases Susceptibility to Mycobacterium tuberculosis Infection. Frontiers in Immunology, 9. https://doi.org/10.3389/fimmu.2018.00860
- 97. Rocha, P. R. F., Silva, A. D., Godinho, L., Dane, W., Estrela, P., Vandamme, L. K. J., Pereira-Leal, J. B., de Leeuw, D., & Leite, R. B. (2018). Collective electrical oscillations of a diatom population induced by dark stress. *Scientific Reports*, 8(1). https://doi.org/10.1038/s41598-018-23928-9
- 98. Rodrigues, Y. K., van Bergen, E., Alves, F., Duneau, D., & Beldade, P. (2018). Complex effects of day and night temperature fluctuations on thermally plastic traits in a seasonal plasticity model. *BioRxiv*. https://doi.org/10.1101/207258
- 99. Rodrigues-Duarte, L., Pandya, Y., Neres, R., & Penha-Gonçalves, C. (2018). Fetal and Maternal Innate Immunity Receptors Have Opposing Effects on the Severity of Experimental Malaria in Pregnancy: Beneficial Roles for Fetus-Derived Toll-Like Receptor 4 and Type I Interferon Receptor 1. Infection and Immunity, 86(5). https://doi.org/10.1128/IAI.00708-17
- 100. Rodríguez, W., Mazet, O., Grusea, S., Arredondo, A., Corujo, J. M., Boitard, S., & Chikhi, L.

- (2018). The IICR and the non-stationary structured coalescent: towards demographic inference with arbitrary changes in population structure. *Heredity*, 121(6), 663–678. https://doi.org/10.1038/s41437-018-0148-0
- 101. Rojas, R. G., Patiño, F., Pérez, J., Medina, C., Lares, M., Méndez, C., Aular, J., Parkhouse, R. M. E., & Cortéz, M. M. (2018). Transmission of porcine cysticercosis in the Portuguesa state of Venezuela. *Tropical Animal Health and Production*. https://doi.org/10.1007/s11250-018-1671-y
- 102. Romo, M. L., Carpio, A., Parkhouse, R. M. E., Cortéz, M. M., & Rodríguez-Hidalgo, R. (2018). Comparison of complementary diagnostic tests in cerebrospinal fluid and serum for neurocysticercosis. *Heliyon*, 4(12), e00991. https://doi.org/10.1016/j.heliyon.2018.e00991
- 103. Rosmaninho, P., Mükusch, S., Piscopo, V., Teixeira, V., Raposo, A. A., Warta, R., Bennewitz, R., Tang, Y., Herold-Mende, C., Stifani, S., Momma, S., & Castro, D. S. (2018). Zeb1 potentiates genome-wide gene transcription with Lef1 to promote glioblastoma cell invasion. *The EMBO Journal*, 37(15), e97115. https://doi.org/10.15252/embj.201797115
- 104. Salmona, J., Rasolondraibe, E., Jan, F., Rakotonanahary, A. N., Ralantoharijaona, T., Pors, B. L., Ousseni, D. S. A., Aleixo-Pais, I., Marques, A. J. D., Sgarlata, G. M., Teixeira, H., Gabillaud, V., Miller, A., Ibouroi, M. T., Zaonarivelo, J. R., Andriaholinirina, N. V., & Chikhi, L. (2018). The unique and isolated Phaner population of Analafiana (Vohémar, SAVA). In *Lemur News* (Vol. 21, pp. 31–36). Retrieved from http://www.aeecl.org/lemurnews/lemurnews2018_21.pdf
- 105. Sánchez, L., & Chaouiya, C. (2018). Logical modelling uncovers developmental constraints for primary sex determination of chicken gonads. *Journal of The Royal Society Interface*, 15(142), 20180165. https://doi.org/10.1098/rsif.2018.0165
- 106. Sánchez-Hernández, L., Montero, L., Mojica-Espinosa, R., Reyes-Grajeda, J. P., Cervantes-Torres, J., Parkhouse, R. M., Fragoso, G., & Sciutto, E. (2018). Impact of the GK-1 adjuvant on peritoneal macrophages gene expression and phagocytosis. *Immunology Letters*, 201, 20–30. https://doi.org/10.1016/j.imlet.2018.10.010
- 107. Scerri, E. M. L., Thomas, M. G., Manica, A., Gunz, P., Stock, J. T., Stringer, C., Grove, M., Groucutt, H. S., Timmermann, A., Rightmire, G. P., d'Errico, F., Tryon, C., Drake, N., Brooks, A.

- S., Dennell, R., Durbin, R., Henn, B., Lee-Thorp, J., deMenocal, P., Petraglia, Ç. D., Thompson, J. C., Scally, Q., & Chikhi, L. (2018). Did Our Species Evolve in Subdivided Populations across Africa, and Why Does It Matter? *Trends in Ecology & Evolution*, 33(8), 582–594. https://doi.org/10.1016/j.tree.2018.05.005
- 108. Schneeberger, M., Tan, K., Nectow, A. R., Parolari, L., Caglar, C., Azevedo, E., Li, Z., Domingos, A., & Friedman, J. M. (2018). Functional analysis reveals differential effects of glutamate and MCH neuropeptide in MCH neurons. *Molecular Metabolism*, 13, 83–89. https://doi.org/10.1016/j.molmet.2018.05.001
- 109. Seixas, E., Escrevente, C., Seabra, M. C., & Barral, D. C. (2018). Rab GTPase regulation of bacteria and protozoa phagocytosis occurs through the modulation of phagocytic receptor surface expression. *Scientific Reports*, 8(1). https://doi.org/10.1038/s41598-018-31171-5
- 110. Semedo-Aguiar, A., Pereira-Leal, J., & Leite, R. (2018). Microbial Diversity and Toxin Risk in Tropical Freshwater Reservoirs of Cape Verde. *Toxins*, 10(5), 186. https://doi.org/10.3390/toxins10050186
- 111. Serrado Marques, J., Teixeira, V., Jacinto, A., & Tavares, A. (2018). Identification of Novel Hemangioblast Genes in the Early Chick Embryo. *Cells*, 7(2), 9. https://doi.org/10.3390/cells7020009
- 112. Sgarlata, G. M., Salmona, J., Aleixo-Pais, I., Rakotonanahary, A., Sousa, A. P., Kun-Rodrigues, C., Ralantoharijaona, T., Jan, F., Zaranaina, R., Rasolondraibe, E., Zaonarivelo, J. R., Andriaholinirina, N. V., & Chikhi, L. (2018). Genetic Differentiation and Demographic History of the Northern Rufous Mouse Lemur (*Microcebus tavaratra*) Across a Fragmented Landscape in Northern Madagascar. *International Journal of Primatology*, 39(1), 65–89. https://doi.org/10.1007/s10764-018-0015-0
- 113. Sharma, R., Goossens, B., Heller, R., Rasteiro, R., Othman, N., Bruford, M. W., & Chikhi, L. (2018). Genetic analyses favour an ancient and natural origin of elephants on Borneo. *Scientific Reports*, 8(1). https://doi.org/10.1038/s41598-017-17042-5
- 114. Silva, I. N., Pessoa, F. D., Ramires, M. J., Santos, M. R., Becker, J. D., Cooper, V. S., & Moreira, L. M. (2018). The OmpR Regulator of

- Burkholderia multivorans Controls Mucoid-to-Nonmucoid Transition and Other Cell Envelope Properties Associated with Persistence in the Cystic Fibrosis Lung. Journal of Bacteriology, 200(17). https://doi.org/10.1128/JB.00216-18
- 115. Silva, R. D., Mirkovic, M., Guilgur, L. G., Rathore, O. S., Martinho, R. G., & Oliveira, R. A. (2018). Absence of the Spindle Assembly Checkpoint Restores Mitotic Fidelity upon Loss of Sister Chromatid Cohesion. *Current Biology*, 28(17), 2837–2844.e3. https://doi.org/10.1016/j.cub.2018.06.062
- 116. Sousa, D. C., Leal, I., Moreira, S., Dionísio, P., Abegão Pinto, L., & Marques-Neves, C. (2018). Hypoxia challenge test and retinal circulation changes a study using ocular coherence tomography angiography. *Acta Ophthalmologica*, *96*(3), e315–e319. https://doi.org/10.1111/aos.13622
- 117. Souto-Maior, C., Sylvestre, G., Braga Stehling Dias, F., Gomes, M. G. M., & Maciel-de-Freitas, R. (2018). Model-based inference from multiple dose, time course data reveals Wolbachia effects on infection profiles of type 1 dengue virus in Aedes aegypti. *PLOS Neglected Tropical Diseases*, 12(3), e0006339—. https://doi.org/10.1371/journal.pntd.0006339
- 118. Staats, R., Rodrigues, R., Barros, A., Bacelar-Nicolau, L., Aguiar, M., Fernandes, D., Moreira, S., Simões, A., Silva-Santos, B., Rodrigues, J. V., Barbara, C., de Almeida, A. B., Moita, L. F. (2018). Decrease of perforin positive CD3+γδ-T cells in patients with obstructive sleep disordered breathing. Sleep and Breathing, 22(1), 211–221. https://doi.org/10.1007/s11325-017-1602-6
- 119. Szakonyi, D., & Duque, P. (2018). Alternative Splicing as a Regulator of Early Plant Development. Frontiers in *Plant Science*, 9. https://doi.org/10.3389/fpls.2018.01174
- 120. Teixeira, M. C., Monteiro, P. T., Palma, M., Costa, C., Godinho, C. P., Pais, P., Cavalheiro, M., Antunes, M., Lemos, A., Pedreira, T, & Sá-Correia, I. (2018). YEASTRACT: an upgraded database for the analysis of transcription regulatory networks in Saccharomyces cerevisiae. *Nucleic Acids Research*, 46(D1), D348–D353. https://doi.org/10.1093/nar/gkx842
- 121. van Bergen, E., & Beldade, P. (2018). Seasonal plasticity for anti-predatory strategies: matching colour and colour preference for effective crypsis. *BioRxiv*. https://doi.org/10.1101/253906

- **122.** Van Dooren, T., Beldade, P., & Allen, C. (2018). Predicting and Analyzing the Response to Selection on Correlated Characters. *BioRxiv*. https://doi.org/10.1101/348896
- 123. Varela, P. L., Lynce, I., Manquinho, V., Chaouiya, C., & Monteiro, P. T. (2018). Stable States of Boolean Regulatory Networks Composed Over Hexagonal Grids. *Electronic Notes in Theoretical Computer Science*, 335, 113–130. https://doi.org/10.1016/j.entcs.2018.03.011
- 124. Varela, P. L., Ramos, C. V., Monteiro, P. T., & Chaouiya, C. (2018). EpiLog: A software for the logical modelling of epithelial dynamics. F1000Research, 7, 1145. https://doi.org/10.12688/f1000research.15613.1
- 125. Wudick, M. M., Portes, M. T., Michard, E., Rosas-Santiago, P., Lizzio, M. A., Nunes, C. O., Campos, C., Damineli, D. S. C., Carvalho, J. C., Lima, P. T., Pantoja, O., & Feijó, J. A. (2018). CORNICHON sorting and regulation of GLR channels underlie pollen tube Ca2+homeostasis. Science, 360(6388), 533–536. https://doi.org/10.1126/science.aar6464
- **126.** Xavier, K. B. (2018). Bacterial interspecies quorum sensing in the mammalian gut microbiota. *Comptes Rendus Biologies*, *341*(5), 300. https://doi.org/10.1016/j.crvi.2018.04.004
- 127. Yang, S., Toledo, E. M., Rosmaninho, P., Peng, C., Uhlén, P., Castro, D. S., & Arenas, E. (2018). A Zeb2-miR-200c loop controls midbrain dopaminergic neuron neurogenesis and migration. *Communications Biology*, 1(75). https://doi.org/10.1038/s42003-018-0080-0
- 128. Zufall, F., & Domingos, A. I. (2018). The structure of Orco and its impact on our understanding of olfaction. *The Journal of General Physiology*, 150(12), 1602–1605. https://doi.org/10.1085/jgp.201812226

Epub ahead of print

- 129. Montenegro Gouveia, S., Zitouni, S., Kong, D., Duarte, P., Ferreira Gomes, B., Sousa, A. L., Tranfield, E. M., Hyman, A., Loncarek, J., Bettencourt-Dias, M. (2018). PLK4 is a microtubule-associated protein that self-assembles promoting *de novo* MTOC formation. *Journal of Cell Science*. https://doi.org/10.1242/jcs.219501
- 130. Pais, T. F., & Penha-Gonçalves, C. (2018). Brain endothelium: the "innate immunity re-

sponse hypothesis" in cerebral malaria pathogenesis. Frontiers in Immunology. Retrieved from https://www.frontiersin.org/articles/10.3389/fimmu.2018.03100/abstract

IGC current addresss

- **131.** Ademolue, T. W., & Awandare, G. A. (2018). Evaluating antidisease immunity to malaria and implications for vaccine design. *Immunology*, 153(4), 423–434. https://doi.org/10.1111/imm.12877
- 132. Pinto, R. A., Almeida-Santos, J., Lourenço, R., & Saúde, L. (2018). Identification of Dmrt2a downstream genes during zebrafish early development using a timely controlled approach. BMC *Developmental Biology*, 18(1). https://doi.org/10.1186/s12861-018-0173-5
- 133. Santana-Calvo, C., Romero, F., López-González, I., & Nishigaki, T. (2018). Robust evaluation of intermolecular FRET using a large Stokes shift fluorophore as a donor. *BioTechniques*, *65*(4), 211–218. https://doi.org/10.2144/btn-2018-0041
- **134.** Varela, S. A. M., Matos, M., & Schlupp, I. (2018). The role of mate-choice copying in speciation and hybridization: Mate-choice copying, speciation and hybridization. *Biological Reviews*, *93*(2), 1304–1322. https://doi.org/10.1111/brv.12397
- 135. Woo, A. C., Faure, L., Dapa, T., & Matic, I. (2018). Heterogeneity of spontaneous DNA replication errors in single isogenic *Escherichia coli* cells. *Science Advances*, 4(6), eaat1608. https://doi.org/10.1126/sciadv.aat1608

Associated groups

- 136. Argyropoulou, Z., Liu, L., Ozoemena, L., Branco, C. C., Senra, R., Reis-Rego, Â., & Mota-Vieira, L. (2018). A novel PLEC nonsense homozygous mutation (c.7159G > T; p.Glu2387*) causes epidermolysis bullosa simplex with muscular dystrophy and diffuse alopecia: a case report. $BMC\ Dermatology,\ 18(1).\ https://doi.org/10.1186/s12895-018-0069-x$
- 137. Asif, M., Martiniano, H. F. M. C. M., Vicente, A. M., & Couto, F. M. (2018). Identifying disease genes using machine learning and gene functional similarities, assessed through Gene Ontology. *PLOS ONE*, 13(12), e0208626. https://doi.org/10.1371/journal.pone.0208626
- 138. Cardoso, M. C., Raposo, M. I., Ormonde, M., Monteiro, R., Sampaio, A., Cosme, P., &

- Mota-Vieira, L. (2018). Prenatal sonographic diagnosis of isolated fetal ascites in cri-du-chat (5p-) syndrome: A case report. *Journal of Clinical Ultrasound*. https://doi.org/10.1002/jcu.22679
- 139. Dias Pereira, B., Nunes da Silva, T., Bernardo, A. T., César, R., Vara Luiz, H., Pacak, K., & Mota-Vieira, L. (2018). A Clinical Roadmap to Investigate the Genetic Basis of Pediatric Pheochromocytoma: Which Genes Should Physicians Think About? *International Journal of Endocrinology*, 2018, 1–14. https://doi.org/10.1155/2018/8470642
- 140. Esteves, L. M., Bulhões, S. M., Branco, C. C., Carreira, T., Vieira, M. L., Gomes-Solecki, M., & Mota-Vieira, L. (2018). Diagnosis of Human Leptospirosis in a Clinical Setting: Real-Time PCR High Resolution Melting Analysis for Detection of Leptospira at the Onset of Disease. *Scientific Reports*, 8(1). https://doi.org/10.1038/s41598-018-27555-2
- 141. Fonseca, V. R., Romão, V. C., Água-Doce, A., Santos, M., López-Presa, D., Ferreira, A. C., Fonseca, J. E., & Graça, L. (2018) The Ratio of Blood T Follicular Regulatory Cells to T Follicular Helper Cells Marks Ectopic Lymphoid Structure Formation While Activated Follicular Helper T Cells Indicate Disease Activity in Primary Sjögren's Syndrome. Arthritis & Rheumatology, 70(5), 774-784. https://doi.org/10.1002/art.40424
- 142. Gama, J. A., Zilhão, R., & Dionisio, F. (2018). Impact of plasmid interactions with the chromosome and other plasmids on the spread of antibiotic resistance. *Plasmid*, *99*, 82–88. https://doi.org/10.1016/j.plasmid.2018.09.009
- 143. Mensurado, S., Rei, M., Lança, T., Ioannou, M., Gonçalves-Sousa, N., Kubo, H., Malissen, M., Papayannopoulos, V., Serre, K., & Silva-Santos, B. (2018). Tumor-associated neutrophils suppress pro-tumoral IL-17+ γδ T cells through induction of oxidative stress. *PLOS Biology*, *16*(5), e2004990. https://doi.org/10.1371/journal.pbio.2004990
- 144. Romão, V. C., Fonseca, J. E., Agua-Doce, A., & Graca, L. (2018). T Follicular Regulatory Cells Are Decreased in Patients With Established Treated Rheumatoid Arthritis With Active Disease: Comment on the Article by Liu et al. Arthritis & Rheumatology, 70(11), 1893–1895. https://doi.org/10.1002/art.40586
- 145. Stebegg, M., Kumar, S. D., Silva-Cayetano, A., Fonseca, V. R., Linterman, M. A., & Graca,

- L. (2018). Regulation of the Germinal Center Response. *Frontiers in Immunology*, 9. https://doi.org/10.3389/fimmu.2018.02469
- 146. Vaz, S. O., Dâmaso, C., Liu, L., Ozoemena, L., & Mota-Vieira, L. (20185-6). Severe phenotype of junctional epidermolysis bullosa generalised intermediate type caused by homozygous COL17A1:c.505C>T (p.Arg169*) mutation. European Journal of Dermatology, (3), 412–413. https://doi.org/10.1684/ejd.2018.3279

PhD programme

- 147. Maia, H. A., Morais, R. A., Siqueira, A. C., Hanazaki, N., Floeter, S. R., & Bender, M. G. (2018). Shifting baselines among traditional fishers in São Tomé and Príncipe islands, Gulf of Guinea. *Ocean & Coastal Management*, 154, 133–142. https://doi.org/10.1016/j.ocecoaman.2018.01.006
- 148. Rodrigues, N. V., Correia, D. V., Mensurado, S., Nóbrega-Pereira, S., deBarros, A., Kyle-Cezar, F., Tutt, A., Hayday, A. C., Norell, H., Silva-Santos, B., & Dias, S. (2018). Low-Density Lipoprotein Uptake Inhibits the Activation and Antitumor Functions of Human Vγ9Vδ2 T Cells. Cancer Immunology Research, 6(4), 448–457. https://doi.org/10.1158/2326-6066.cir-17-0327
- 149. Zacarias, D., & Loyola, R. (2018). Distribution modelling and multi-scale landscape connectivity highlight important areas for the conservation of savannah elephants. *Biological Conservation*, 224, 1–8. https://doi.org/10.1016/j.biocon.2018.05.014

Other Publications 2018

Proceedings

- 1. Caré, R., & Mena, A.L. (2018). Gaming and Animal Research: creating a video game script. In A. A. Carvalho, J. P. Pons, C. G. Marques, S. Cruz, A. Moura, I. L. Santos & D. Guimarães (Ed.), Atas do 4º Encontro sobre Jogos e Mobile Learning (pp. 94-101). Coimbra, Portugal: CEIS20. Retrieved from http://hdl.handle.net/10316/48542
- 2. R.B. Correia, N. Ratkiewicz, A. Barrat, L.M. Rocha [2018]. The Metric Backbone of Contact Networks in Epidemic Spread Models. Paper and Materials presented at NetSci 2018: International School and Conference on Network Science. Retrieved from https://www.informatics.indiana.edu/rocha/publications/SM/

Book Chapters

- 3. de-Carvalho, J., Deshpande, O., Nabais, C., & Telley, I. A. (2018). A cell-free system of *Drosophila* egg explants supporting native mitotic cycles. In *Methods in Cell Biology* (Vol. 144, pp. 233–257). Elsevier. https://doi.org/10.1016/bs.m-cb.2018.03.011
- 4. Garcês, S., & Demengeot, J. (2018). The Immunogenicity of Biologic Therapies. In L. Puig & W. Gulliver (Eds.), Current Problems in Dermatology (Vol. 53, pp. 37–48). S. Karger AG. https://doi.org/10.1159/000478077
- 5. Silva, F. da, Minhós, T., & Bruford, M. W. (2018). Primate conservation genetics. In *The International Encyclopedia of Biological Anthropology*. John Wiley and Sons, Inc. https://doi.org/10.1002/9781118584538.ieba0400
- 6. Siwek, W., Gómez-Rodríguez, M., Sobral, D., Corrêa, I. R., & Jansen, L. E. T. (2018). time-ChIP: A Method to Determine Long-Term Locus-Specific Nucleosome Inheritance. In G. A. Orsi &

- G. Almouzni (Eds.), *Histone Variants* (Vol. 1832, pp. 131–158). New York, NY: Springer New York. https://doi.org/10.1007/978-1-4939-8663-7_7
- 7. Soares, M. A. F., & Castro, D. S. (2018). Chromatin Immunoprecipitation from Mouse Embryonic Tissue or Adherent Cells in Culture, Followed by Next-Generation Sequencing. In N. Visa & A. Jordán-Pla (Eds.), *Chromatin Immunoprecipitation* (Vol. 1689, pp. 53–63). New York, NY: Springer New York. https://doi.org/10.1007/978-1-4939-7380-4_5

Other

- 8. Chikhi, Lounés, & d'Errico, F. (n.d.). Afrique. Ni d'Ève ni d'Adam : les origines d'*Homo sapiens*. In *Archéologia n° 569* (pp. 12–13).
- Bill, S. (2018). The Two Cultures: Where are we now? The FEBS Journal, 285(10), 1786–1790. https://doi.org/10.1111/febs.14387
- 10. Bezjak, S., Clyburne-Sherin, A., Conzett, P., Fernandes, P., Görögh, E., Helbig, K., Kramer, B., Labastida, I., Niemeyer, K., Psomopoulos, F., Ross-Hellauer, T., Schneider, R., Tennant, J., Verbakel, E., Brinken, H., & Lambert Heller. (2018). Open Science Training Handbook (Version 1.0). Zenodo. https://doi.org/10.5281/zenodo.1212496



50
Prizes & Honours

PRIZES & HONOURS

Prizes & Honours 2018

ADRAIN, Colin

Editorial Board Member, The FEBS Journal Editorial Board Member, Scientific Reports Editorial Board Member, Cells

AMORIM, Maria João

International Visitor Leadership Program USA — Project Women in STEAM Fields "Hidden no more", United States Department of State

BALBOTIN, Roberto

Marie S. Curie Individual Fellowship, European Commission

BANK, Claudia

SSE Graduate Travel Grant for IInd Joint Congress on Evolutionary Biology,

Society for the Study of Evolution, 500 USD

Travel Grant for Evolution of Biomolecular Networks: Rules of the Game, Lorentz Center, $340~\mbox{\ensuremath{\&ombounder}}$

Associate Editor, FEBS Letters

BELDADE, Patrícia

Scientific committee, Joint meeting of ESEB, SSE, ASN, SSB: Evolution 2018

French national evaluation panel (HCERES), Institut Jacques Monod, Paris

Advisory Editorial Board, Development

BETTENCOURT DIAS, Mónica

ERC evaluation panel (LS1),

European Research Council

CARAMALHO, Íris

Concurso Estímulo ao Emprego Científico

— **Individual**, Fundação para a Ciência e Tecnologia

CARDOSO, Sara

Godfrey Hewitt Mobility Award, European Society for Evolutionary Biology

CASTRO, Diogo

President, Portuguese Society for Developmental Biology (SPBD)

CAVADAS, Miguel

Concurso Estímulo ao Emprego Científico — Individual, Fundação para a Ciência e Tecnologia

CHIKHI, Lounès

Editor, Heredity

COSTA, Teresa

Member of Working Group 1

 Mapping of the Portuguese Community of Interface Professionals, Plataforma de Interface a Ciência (PIC)

DIAS, André

Tebu-Bio's Researchers Travel Grants, Tebu-Bio Lab Services and Reagent Company

DUQUE, Paula

Concurso Estímulo ao Emprego Científico — Individual, Fundação para a Ciência e Tecnologia

FAÍSCA, Pedro

Scientific committee, XXIII Meeting of the Portuguese Society of Animal Pathology

Organizing committee, XXIII Meeting of the Portuguese Society of Animal Pathology

FONSECA, Irina

IAST Grant, Support for travel and accom-

modation related to the YASE meeting,

Institute for Advanced Study in Toulouse

FRAGATA, Inês

Guest Editor – issue on "Fitness Landscapes, Big Data and Predictability of Evolution", Heredity

GHENU, Ana-Hermina

SSE Travel Stipend, Society for the Study of Evolution (SSE)

GJINI, Erida

Editorial Board member, Nature Scientific Reports

MALLO, Moisés

Editorial Board member,

Developmental Dynamics

Editorial Board member, International Journal of Developmental Biology

Academic Editor, PLoS ONE

MARTIN MATAS, Guiomar

Marie S. Curie Individual Fellowship, European Commission

MARTINS, Gabriel G.

Scientific committee, SPAOM — Spanish & Portuguese Advanced Optical Microscopy Meeting Scientific committee member, INCOMAM, SPmicros 2018 meeting

MARTINS, Rui

Marie S. Curie Individual Fellowship, European Commission

MARTINS, Vera

Member of the Board of Directors
— Scientific Secretary, Portuguese Society
of Immunology (SPI)

MARTÍNEZ, Noelia

Marie S. Curie Individual Fellowship, European Commission

MOITA, Luís Ferreira

Concurso Estímulo ao Emprego Científico – Individual, Fundação para a Ciência e Tecnologia

OLIVEIRA, Raquel

Concurso Estímulo ao Emprego Científico — Individual, Fundação para a Ciência e Tecnologia

OLIVEIRA, Rui

ERC Evaluation panel (LS8), European Research Council

President, Society for Social Neuroscience

Guest Editor, Frontiers in Behavioral Neuroscience

Member of the Editorial Board, Scientific Reports

Member of the Editorial Board, Social Neuroscience

PAIS, Teresa

Concurso Estímulo ao Emprego Científico — Individual, Fundação para a Ciência e Tecnologia

PESSOA, Delphine

First Prize for student poster, 11th European Conference on Mathematical and Theoretical Biology (ECMTB2018)

Best poster prize, 17th European Conference on Computational Biology (ECCB18)

SOARES, Miguel

Best poster award, Society for Free Radical Research International (SFRRI), sponsored by Elsevier

Editorial board member, Journal of Molecular Medicine

Scientific Committee, 10th International Conference on Heme Oxygenase

SRINIVASAN, Bharath

Marie S. Curie Individual Fellowship, European Commission

VIDAL, Sheila

Member of the Coordination Group, Plataforma de Interface a Ciência (PIC)



GRADUATE EDUCATION & TRAINING

PhD Programme in Integrative Biology and Biomedicine | IBB

Head | SUCENA, Élio

Description of the Programme

The IGC PhD programme offers to a selected group of students the opportunity to learn biology from a combination of resident Institute researchers and invited faculty from many of the world's most prestigious scientific institutions. Students benefit from an intensive academic semester before choosing research groups to join, and writing their thesis projects. Candidates hail from all over the globe, and diverse academic backgrounds. The class of 2018 maintains its international collaboration with the University of Cologne, and the Max Planck Institute for Plant Breeding Research, as well as local partnerships with the

Champalimaud Research (Champalimaud Foundation) and the Instituto de Tecnologia Química e Biológica (ITQB-UNL). Students also benefit from many educational courses and workshops throughout their PhD, including our popular bioinformatics training programme, weekly seminars and an annual retreat. Graduate students drive social life at the Institute, organising cultural events all year round. The IBB programme is supported by the Fundação para Ciência e a Tecnologia and the Calouste Gulbenkian Foundation and its students are awarded their degrees from the Universidade Nova de Lisboa.



Support Staff in 2018

Ana Aranda da Silva · Administrative Assistant

Students admitted in 2018

Abdul Shafi	Bangladeshi	MSc Translational Oncology	University of Hull, UK
Abeer Heskol	Syrian	MSc Medical Science	Uppsala University, Sweden
Ana Eugénio	Portuguese	MSc Evolutionary and Developmental Biology	Faculdade de Ciências da Universidade de Lisboa, Portugal
Ana Milas	Croatian	MSc Chemistry	University of Zagreb, Croatia
Carla Henriques	Portuguese	MSc in Biomedical Research Neurobiology	University of Coimbra, Portugal
Carmen Santana	Mexican	MSc Biochemistry	Universidad Nacional Autónoma de México, Mexico
Massimo Amicone	Italian	MSc Bioinformatics	University of Bologna, Italy
Mayra Martínez	Ecuatorian	MSc Cancer Sciences	University of Glasgow, UK
Patrícia Duarte	Portuguese	MSc Molecular Biology and Genetics	Faculdade de Ciências da Universidade de Lisboa, Portugal
Renato Sousa	Portuguese	Molecular and Cellular Biology (Neurobiology)	University of Coimbra, Portugal
Wilson Ademolue	Nigerian	MSc Molecular and Cell Biology of Infectious diseases	University of Ghana, Ghana

Modules & Courses ran in 2018

History of Biological Concepts

Organiser: Élio Sucena

Faculty: Jan Sapp (York University, Canada), Lars Jansen (IGC, Portugal)) and Rui Oliveira (IGC/ ISPA/ Fund. Champalimaud).

Structural and Molecular Biology

Organisers: Lars Jansen and Alekos Athanasiadis Faculty: Alain Vanderplassen (University of Liege, Belgium), Ivo Telley, Erin Transfield, Wojtek Siwek, Alekos Athanasiadis, Lars Jansen.

Cell Biology

Organisers: Mónica Bettencourt Dias, Florence Janody, M^a João Amorim, Colin Adrain and Raquel Oliveira

Faculty: Cayetano González (IRB Barcelona), Gaia Pigino (Max Planck Institute of Molecular Cell Biology and Genetics, Germany), Edgar Gomes (IMM, Portugal), Colin Crump (University of Cambridge, UK), Claudia Almeida (CEDOC, Portugal) and Jorge Azevedo (I3S, Portugal).

Evolution

Organisers: Isabel Gordo, Lounès Chikhi and Claudia Bank

Faculty: Brian Charlesworth (University of Edinburgh, UK), Dan Andersson (Uppsala University, Sweden), Lounès Chikhi (CNRS-Toulouse, France), Claudia Bank, Lounès Chikhi, Isabel Gordo, Dragan Stajic, Alexandre Blanckaert and Inês Fragata (IGC, Portugal).

Developmental Biology

Organisers: Diogo Castro and Moisés Mallo Faculty: Fernando Roch (Centre de Biologie du Développement, Toulouse, France) Ana Tavares (Chronic Diseases Research Center, UNL, Portugal), Ana Ribeiro (IMM, Portugal) Moisés Mallo (IGC), Vera Martins (IGC), Diogo S. Castro (IGC), Noelia Urban (IMBA, Vienna, Austria) and Enrique Amaya (University of Manchester, UK).

Modules & Courses ran in 2018 (cont.)

Immunobiology/Host-Pathogen Interactions

Organisers: Miguel Soares, Vera Martins, Karina Xavier, Luis Moita

Faculty: Thomas Boehm (Max-Planck Institute of Immunobiology and Epigenetics, Freiburg, Germany), David Sancho (CNIC, Madrid, Spain), Bruno Silva Santos (IMM, Portugal), Henrique Veiga-Fernandes (CCU, Portugal), Vasco Barreto (CEDOC, Portugal), António Coutinho, Carlos Penha-Gonçalves, Jocelyne Demengeot, Jonathan Howard, Luís Ferreira Moita, Luís Teixeira, Miguel P. Soares, and Vera Martins (IGC, Portugal).

From Cells to Organisms

Organisers: Miguel Godinho-Ferreira and Ana Domingos

Faculty: Timo Dirk Müller (Institute for Diabetes and Obesity, Germany), Gonçalo Bernardes (Cambridge University and IMM), Miguel Vasques (MD), Thiago Carvalho (F. Champalimaud), Antonio Jacinto and Helena Soares CEDOC), Leonor Saúde (IMM), Miguel Godinho-Ferreira and Ana Domingos (IGC, Portugal).

Systems Biology

Organisers: Claudine Chaouiya and Erida Gjini Faculty: Thierry Mora, (Laboratoire de physique statistique, École normale supérieure, Paris), Aleksandra Walczak (Laboratoire de Physique Théorique, École Normale Supérieure), Joana Sá, Claudine Chaouiya and Erida Djini (IGC, Portugal).

Neurobiology

Organisers: Rui Oliveira and Ana Domingos Faculty: Rui Oliveira (IGC/ISPA, Portugal), Luísa Vasconcelos (CNP, Lisboa), Susana Varela (IGT, Portugal), Rosalina Fonseca (CEDOC, Lisboa), Myriam Aouadi (Karolinska Institute, Sweden), Ana Domingos (IGC, Portugal), Soojin Ryu (Univ. Maiz, DE), Marta Moita (CNP, Lisboa) and Ivan Araújo ((The John B. Pierce Laboratory, USA).

Plant Biology

Organisers: Elena Baena-González, Jörg Becker and Paula Duque

Faculty: Ute Höcker (University of Cologne, Germany) and Viviana Correa-Galvis (Max Planck Institute of Molecular Plant Physiology, Potsdam-Golm, Germany).

Hypothesis Driven Research

Organiser: Jocelyne Demengeot, Miguel Godinho Ferreira and Élio Sucena

Faculty: Jocelyne Demengeot, Miguel Godinho Ferreira, Élio Sucena and António Coutinho (IGC, Portugal).

Methods in Integrative Biology

Organiser: Nuno Moreno

Faculty: Ricardo Henriques (UCL,UK), Sofia Rebelo (IBET, Portugal), Spencer Shorte (Institute Pasteur, FR), Nuno Moreno, Marta Monteiro, Gabriel Martins, Nuno Martins, Ana Regalado, Rui Faísca, João Sousa, Moisés Mallo, Manuel Rebelo, Jörg Becker and Daniel Sobral (IGC, Portugal).

Statistics and Quantitative Biology

Organiser: Jorge Carneiro

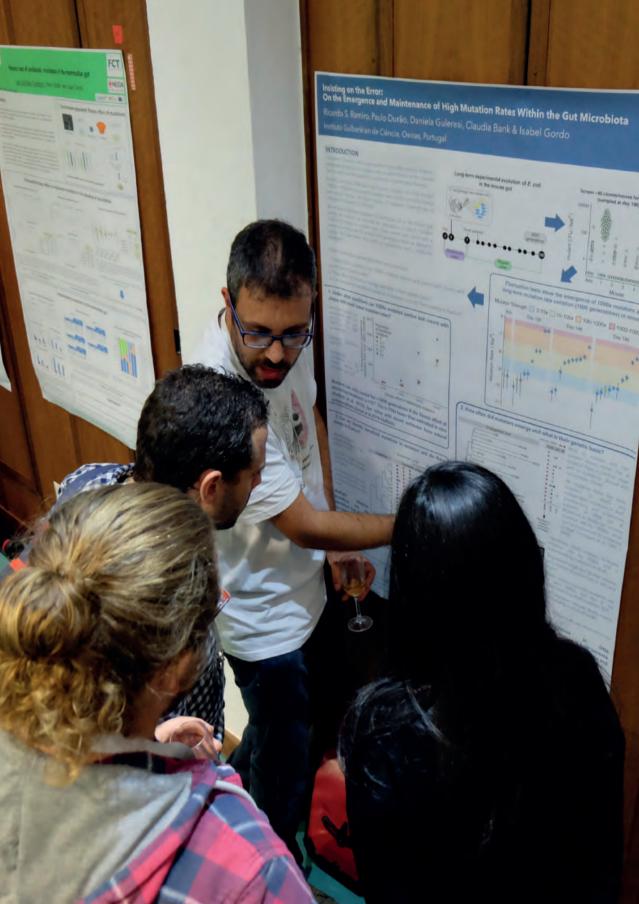
Faculty: Nuno Sepúlveda (London School of Hygiene and Tropical Medicine, UK) and Jorge Carneiro (IGC, Portugal).

Bioinformatics

Organiser: Pedro L. Fernandes

Faculty: David P. Judge, Pedro L. Fernandes

and Daniel Sobral (IGC, Portugal).



PhD Programme Biology at the Host Microbe Interface

Heads | HENRIQUES, Adriano (ITQB); SOARES, Miguel (IGC); MOTA, Maria (iMM)

Description of the Programme

The Biology at the Host Microbe Interface (INTERFACE) PhD programme was created on the premise that understanding the general principles guiding host-microbe interactions is a major scientific endeavor *per se* with a potential global translational impact on therapeutic intervention against infectious as well as non-communicable diseases. The INTERFACE PhD programme aims at fulfilling a current gap of knowledge at the interface of these multidisciplinary scientific areas. The INTERFACE programme brings together three internationally renowned institutions in the Lisbon area, with strong proficiency in the field of host-microbe interactions: Instituto de Tecnologia Química e Biológica (ITQB NOVA), In-

stituto Gulbenkian de Ciência (IGC) and Instituto de Medicina Molecular (iMM).

ITQB/IGC/iMM provide the Interface programme with a rich and exciting training and research environment that can be easily adjusted to specific expectations and needs. The Interface students are exposed to a culture of rigor, excellence, innovation and cutting edge performance at the research, training and administrative levels, that characterizes the three Institutions.

The programme has close ties with biopharmaceutical companies and also with the European Centers for Disease Control and Prevention, which adds to the pool of training opportunities for students.



Support Staff in 2018

Ana Aranda da Silva · Administrative Assistant

Students admitted in 2018

Adriana Beatriz Oliveira Temporão	Portuguese	MSc Biomedical Sciences: Molecular Biology in Tropical and International Health	Instituto de Higiene e Medicina Tropical, UNL, Portugal
André Boler Cláudio da Silva Barros	Portuguese	MSc Ecology and Environmental Management	Faculdade de Ciências da Universidade de Lisboa, Portugal
Daryna Piontkivska	Portuguese	MSc Biochemistry for Health	ITQB, UNL, Portugal
Joana Lisboa da Silva Gonçalves	Portuguese	MSc Biochemistry for Health	ITQB, UNL, Portugal
Leandro Joel Barros Fernandes	Portuguese	MSc Biochemistry	Faculdade de Ciências da Universidade do Porto, Portugal
Sandro Ribeiro Lopes	Portuguese	MSc Celular and Molecular Biology	Faculdade de Ciências e Tecnolo- gia da Universidade de Coimbra, Portugal
Sónia Maria Leite Pereira	Portuguese	MSc Microbiology	Universidade do Algarve, Portugal

Modules & Courses ran in 2018

FEBRUARY 26-MARCH 02

History of infectious disieases

Organiser: Adriano Henriques, Élio Sucena and

Thiago Carvalho

Faculty: Adriano Henriques (ITQB, PT), Thiago Carvalho (F. Champalimaud, PT), Adriano Aguzzi (Director, Institute of Neuropathology, University Hospital, Zurich, Switzerland), Ivaylo Ivanov (Department of Microbiology and Immunology, Columbia University, New York, USA).

MARCH 05-09

Gene Expression and Systems Biology

Organisers: Zach Hensel

MARCH 12-16

Microbial Cell Biology

Organisers: Adriano Henriques and Mariana Pinho

MARCH 19-23

Host-Microbe Interactions I

Organisers: Raquel Sá-Leão and Mónica Serrano

APRIL 02-06

Host Cell Biology

Organisers: Jaime Mota, Sérgio Filipe and Luís Teixeira APRIL 09-13

Evolution and Dynamics of the HMI

Organisers: Karina Xavier and Isabel Gordo

APRIL 16-20

Immunobiology

Organiser: Miguel Soares, Luís Moita and Marc Veldhoen

Faculty: Gabriel Núñez (University of Michigan, USA), Miguel Soares (Instituto Gulbenkian de Ciência), Luís Ferreira Moita (Instituto Gulbenkian de Ciência), Marc Veldhoen (Instituto de Medicina Molecular), Vera Martins (Instituto Gulbenkian de Ciência), Jocelyne Demengeot (Instituto Gulbenkian de Ciência), António Coutinho (Instituto Gulbenkian de Ciência/Fundação Champalimaud), Miguel Prudêncio (Instituto de Medicina Molecular).

APRIL 30-MAY 04

Host-Microbe Interactions II

Organisers: Maria Mota, Luísa Figueiredo and Miguel Prudêncio

MAY 07-25

Statistics and Quantitative Biology

Organisers: Instituto de Medicina Molecular

Graduate Programme Science for Development | PGCD

Heads | GONÇALVES SÁ, Joana & BELDADE, Patrícia

Description of the Programme

The Graduate Programme Science for Development (PGCD in the Portuguese acronym) is an advanced training programme, designed to prepare students from the various Portuguese Speaking African Countries (PALOP) and East-Timor to pursue research careers in Science and Technology. This programme started in January 2014, and ran until 2017, offering 55 students the opportunity to learn advanced life sciences. The IGC coordinated the programme with support from the Ministry of Education, Cabo Verde, the FCT, Portugal and CAPES, Brazil, and several sponsors, most notably Merck.

The programme offers basic training in life sciences, paying particular attention to Plant Biology, Marine Biology and Tropical Diseases. In

addition to the science curriculum, the PGCD students had an English course, the language of science. The programme's structure consisted on one year of graduate courses, taking place in Praia, Cape Verde, followed by a 3 to 4 year research period leading to a PhD thesis.

The main goals of the PGCD are three-fold:

- 1) To train a new generation of excellent Portuguese-speaking African and Timorese students, giving them the opportunity to learn advanced science and become scientists:
- 2) To improve the quality of science education and scientific research in the and East-Timor;
- To use science and technology as effective tools for development.



Support Staff in 2018

Carla Semedo · PGCD Coordinator in Cabo Verde

Gulbenkian Training Programme in Bioinformatics | GTPB

Head | FERNANDES, Pedro L.

Description of the Programme

The GTPB runs face-to-face Bioinformatics Training Courses regularly at the Instituto Gulbenkian de Ciência since 1999. Up to now, more than 5290 course participants have acquired practical skills that they can use with a high degree of independence.

The Programme consists of a series of short, intensive hands-on courses delivered and fully documented in English. The design of the courses is based on sets of carefully chosen exercises, flanked by short lectures and participative interaction sessions. The training methodology is based on active learning principles. A set of courses addresses recognised needs in a stable manner, whereas new themes are introduced each year to allow for novel areas where Bioinformatics is making new impacts.

The active learning methods maximise participant engagement with group work and instant feedback. The participants are led to a continuous self-assessment that gauges the accumulation of skills and the degree of confidence in using them without help. The questionnaires at the end of each course are used to plan future editions and to evaluate participant satisfaction.



Support Staff in 2018

Joana Marques | Left in April Alexandra Caetano Miguel Cardoso | Started in October

News in 2018

Pedro L. Fernandes initiated a collaboration with H3ABioNet in the planning and provision of distance learning. This includes two initiatives: i) Introduction to Bioinformatics course (IBT), a formal pan-African programme involving 29 universities and about 896 students; and ii) African Genomic Medicine Training Initiative (AGMT),

which aims at increasing the effectiveness of Health Care in Africa through the application of Genomic Medicine. H3ABioNet was established to develop bioinformatics capacity in Africa and specifically to enable genomics data analysis by H3Africa researchers across the continent.

Email · pfern@igc.gulbenkian.pt
IGC Webpage · http://www.igc.gulbenkian.pt/education/gtpb
External Website · http://gtpb.igc.gulbenkian.pt/bicourses

Modules & Courses ran in 2018

FEBRUARY 19-23

ELB18F – Entry Level Bioinformatics (First course 2018)

Faculty: David P. Judge (Freelance independent Bioinformatics instructor, UK), Pedro L. Fernandes (IGC, Portugal) and Daniel Sobral (IGC, Portugal).

MARCH 6-9

CPANG18 – Computational PANGenomics

Faculty: Tobias Marcshall (IMPRS-CS and Saarland University, Germany) and Erik Garrison (Cambridge University, UK).

APRIL 3-6

ABSTAT18 – Advanced Biostatistics for Bioinformatics Tool Users using R

Faculty: Lisete Sousa (FCUL, Portugal) and Carina Silva (ESTeSL, Portugal)

APRIL 9-12

ADER18F – Analysis of Differential Expression with RNAseq (First course 2018)

Faculty: Daniel Sobral (IGC, Portugal), Daniel Faria (IGC, Portugal) and Daniel Neves (IGC, Portugal).

MAY 14-18

PGDH18 – Population Genetics and Demographic History

Faculty: Mark Beaumont (Bristol University, UK), Lounès Chikhi (CNRS, France; IGC, Portugal), Willy Rodriguez (INRA, France) and Vitor Sousa (FCUL, Portugal).

MAY 28-JUN 01

PDA18 - Proteomics Data Analysis

Faculty: Lennart Martens (UGent and VIB, Belgium), Harald Barsnes (UiB, Norway) and Lieven Clement (UGent and VIB, Belgium).

JULY 23-27

PPB18 – Programming in Python for Biologist

Faculty: Allegra Via (IBPM-CNR, Italy), Vincenza Colonna (IGB-CNR, Italy) and David P. Judge (Freelance independent Bioinformatics instructor, UK).

SEPTEMBER 17-21

3DAROC18 – 3C-based data analysis and 3D reconstruction of chromatin folding

Faculty: Marc A. Marti-Renom (CNAG and CRG, Spain), François Serra (CNAG and CRG, Spain), David Castillo (CNAG and CRG, Spain), Jürgen Walther (IRB, Spain) and Diana Buitrago (IRB, Spain).

OCTOBER 18-12

ADER18S – Analysis of Differential Expression with RNAseq (Second course 2018)

Faculty: David P. Judge (Freelance independent Bioinformatics instructor, UK), Pedro L. Fernandes (IGC, Portugal) and Daniel Sobral (IGC, Portugal).

NOVEMBER 5-9

ELB18F – Entry Level Bioinformatics (Second course 2018)

Faculty: David P. Judge (Freelance independent Bioinformatics instructor, UK), Pedro L. Fernandes (IGC, Portugal) and Daniel Sobral (IGC, Portugal).

Postdoctoral Training

Scientific Coordinators | XAVIER, Karina & ADRAIN, Colin

Description of the Programme and Activities

The Postdoc Committee, a panel of postdoc volunteers, assists in professional development, fosters a solid institutional environment and provides a 'peer support' for postdocs. This year, the Committee organized activities including: Portuguese classes; the "20 minutes with" seminar series (to promote scientific discussions); "Coffee with the PI" and "Career path in science" sessions (informal conversations between postdocs and PIs/scientific visitors about all aspects of scientific life). Postdocs also organized a Scientific symposium on Microbial Eco-Evolutionary Dynamics and, with the RFA Unit, hosted a Workshop on "Advice to improve your CV". Several new schemes were introduced in 2018, including the Postdoc Mentorship Programme. Tailored to individual career aspirations, the programme promotes career planning and provides postdocs with advice from independent academic or non-academic sources, supplementing mentorship from their own PIs. The Postdoc Training Programme, launched in 2018, aims to broaden/deepen postdoc training, boost their career perspectives, empowering them to become successful independent scientists. Postdocs are encouraged to participate in several courses and career development activities (e.g. Data clubs, Journal Clubs, Lab Meetings, organization of Seminars and meetings). The Postdoc Delegates, a newly appointed group that overlaps with the Committee, forms a bridge between postdocs and the IGC Direction/administration.

Postdoc Committee in 2018

Ana Aranda da Silva Bruno Bastos Gianluca Selvaggio Kety Giannetti Philipp Seidel Rui Martins Rupinder Kaur



Support Staff in 2018

Ana Aranda da Silva · Administrative Assistant

Summer Internship Programme

Coordinators | AMORIM, Maria João; TEIXEIRA, Luís; MARTINS, Gabriel

Description of the Programme

In 2014, the IGC and University of Oxford ran a programme aiming to bring young science undergraduates to the IGC for a lab experience. This programme has since then expanded to accommodate undergraduates studying in other universities in Europe and also from the Lisbon area, including Universidade Nova de Lisboa, Universität Karlsruhe, Pierre and Marie Curie University, Poznan University of Life Science, University of Belgrade, University of Lisbon, Instituto Superior Técnico, Escola Superior de

Tecnologia da Saúde de Lisboa, Universidade de Aveiro, Suez University, and University College London among others. Last year, 16 students were selected to work in the labs of 13 different IGC researchers. The programme initiated on the $23^{\rm rd}$ July with a week of classes, followed by lab work and a final project presentation. The programme had great positive feedback from the students and already had inquires from several national and international students about the next edition.

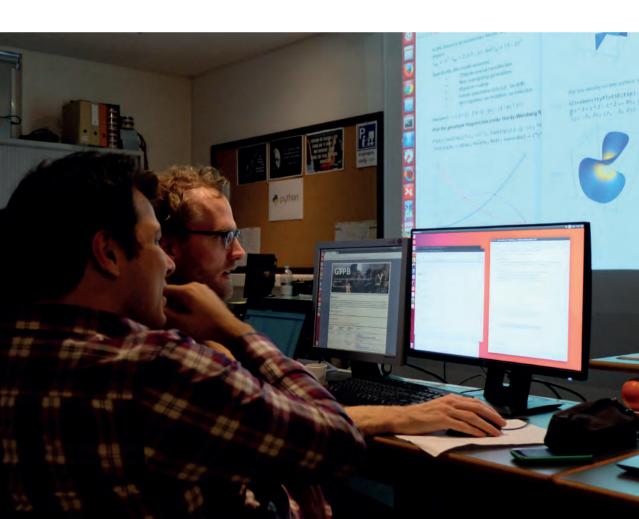


| Hosting groups in 2018

Cell biology of viral infection
Plant Stress Signaling
Variation: Development and Selection
Cell Cycle Regulation
Evolutionary Dynamics
Histopathology

Evolutionary Biology Advanced Imaging Flow Cytometry Chromosome Dynamics Host-Microorganism Interactions Electron Microscopy

Support Staff in 2018



Theses 2018

MSc Theses

ÁVILA, Mariana Esteves

Thymus architecture in primary immunodeficiency and leukemogenesis

Supervisors: Vera Martins

Instituto Superior Técnico, Universidade de Lisboa. Portugal – November

CARREIRA, Leonor

Neural Mechanisms of Social Cognition in Zebrafish

Supervisors: Rui Oliveira

Universidade de Lisboa, Portugal - February

COSTA, Miguel

Peripheral molecular targets for adiposity control Supervisor: Ana Domingos

Instituto Superior Técnico, Portugal – November

DIVERSI, Francesco

Characterisation of sympathetic-neuron-associated macrophages for the development of new pharmaceutical strategies for obesity treatment

Supervisor: Ana Domingos

Università di Pisa, Italy – December

ESSABAR, Mouneem

Computational Approach for Signalling and Regulatory Networks Analysis

Supervisor: Claudine Chaouiya

Mohammed the Vth University, Rabat Morrocco – September

FERREIRA, Ana Rita

Development of cell lines with an inhibited interferon response as a strategy for improved virus yealds

Supervisors: Michael Parkhouse

Instituto Superior Técnico, Universidade de Lisboa, Portugal – May

PAUPÉRIO, Francisco

Assessing optimal treatments for intracellular infection: host immunity, heterogeneity, and the antibiotic resistance challenge

Supervisor: Erida Gjini

Universidade de Lisboa, Portugal - December

RANDRIAMAROSON, François Jacquis

Etude de l'estimation de la densité et la taille de la population des Microcebus spp dans trois forets du nord de Madagascar (Ampiho, Orangia et Montagne d'Ambre)

Supervisor: Lounès Chikhi University of Mahajanga – March

REIS, Diana

Crosstalk between the miRNA and the SnRK1

signaling pathways

Supervisor: Elena Baena-González

Universidade de Lisboa (FCUL) – December

SILVA, Marta

Genetic basis of Wolbachia-mediated antiviral

 $protection\ in\ Drosophila\ melanogaster$

Supervisor: Luís Teixeira

Universidade de Lisboa, Portugal – June

181

PhD Theses

CARVALHO, Edison

Regulation of heterochromatin and telomere length in *S. pombe* (fission yeast)

Supervisor: Miguel Godinho Ferreira

Universidade Nova de Lisboa, Portugal – December

DESHPANDE, Ojas

Cytoskeletal dynamics during internuclear spacing in the *Drosophila* syncytial embryo

Supervisor: Ivo Telley

Universidade Nova de Lisboa, Portugal – February

DUARTE, Elves H.

Molecular bases of *Wolbachia*-host interactions Supervisor: Luís Teixeira

Universidade Nova de Lisboa, Portugal – Septembor

ISIK, Ozlem Aybuke

Functional Characterization of Rib-repressing Activity of Hox PG10 Proteins

Supervisor: Moisés Mallo

Universidade Nova de Lisboa, Portugal - July

LEX, Kirsten

Age as a Carcinogen: are Telomeres the Culprit?

Supervisor: Miguel Godinho Ferreira Universidade Nova de Lisboa, Portugal – December

MIRKOVIC, Mihailo

Cohesion failure and Mitosis: From Molecular Mechanisms to Organismal Consequences

Supervisor: Raquel Oliveira

Universidade Nova de Lisboa, Portugal – July

PAIS, Ricardo

How cells initiate Epithelial-to-Mesenchymal Transition. A computational modelling of cellular and supra-cellular networks to unravel the control of EMT

Supervisor: Claudine Chaouiya

Universidade Nova de Lisboa, Portugal – December

PIRZGALSKA, Roksana

Neuro-immune interactions in obesity Supervisor: Ana Domingos

Universidade Nova de Lisboa (MIT - Portugal) — February

SANTOS, Diogo

Understanding fitness from molecular mechanisms – a step towards predicting evolution

Supervisor: Lília Perfeito

Universidade Nova de Lisboa, Portugal – December

SOARES, Nuno

Understanding adaptation to new ecological niches: the case of *Drosophila* suzukii

Supervisor: Christen Mirth and Patrícia Beldade Universidade Nova de Lisboa, Portugal – March

STAJIC, Dragan

The role of epigenetic mechanisms in adaptive evolution

Supervisor: Lars Jansen and Lília Perfeito Universidade Nova de Lisboa, Portugal – March

VAZ DA SILVA, Zoé

Influenza A virus modulates membrane regulators of complement activation

Supervisor: Maria João Amorim

Universidade Nova de Lisboa, Portugal – February

Teaching at other PhD Programmes 2018

BAENA-GONZÁLEZ, Elena

Intercellular signaling in plants

Advanced Course on Intercellular Communication, University of Coimbra, Coimbra, Portugal

November

BECKER, Jörg

(Epi)genetic basis of sexual reproduction in land plants: A focus on the male gametes, ITQB Plants for Life PhD Programme, Universidade Nova de Lisboa, Lisbon, Portugal – March

CARAMALHO, Íris

Towards the identification of genetic susceptibility factors underlying early onset Type I diabetes PhD Programme in Biological Systems, Functional & Integrative Genomics, Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal – June

CASTRO, Diogo

GABBA PhD Programme, Universidade do Porto, Porto, Portugal – February

HOWARD, Jonathan C.

Cell Autonomous Immunity
PhD in Molecular Biosciences
lectures, ITQB – Universidade
Nova de Lisboa, Lisbon, Portugal – April

MALLO, Moisés

Genetic control of vertebrate axial extension GABBA PhD programme, Universidade do Porto, Porto, Portugal – February

The spinal cord

GABBA PhD Programme, Universidade do Porto, Porto, Portugal – June

MARTINS, Gabriel G.

Light MicroscopyITQB PhD Programme, Oeiras
– January

Light microscopy + Intro to ImageJ ITQB Plants for Life PhD programme, Oeiras – April

Digital Images & Imaging Pitfalls + intro to ImageJ BioISI PhD programme, FCUL, Lisboa, Portugal – June

MOITA, Luís Ferreira

Dendritic Cell Immunobiology



Interface PhD Programme, ITQB/iMM/IGC, Oeiras, Portugal – April

Sepsis

Interface PhD Programme, ITQB/iMM/IGC, Oeiras, Portugal – April

MORENO, Nuno

Tip and Tricks for 2 photon imaging PhD course, University of Milan, Milan, Italy – September

REBELO, Manuel

Biotério e regulamentação para experimentação animal Programa de Doutoramento em Ciências da Saúde, Faculdade de Medicina da Universidade de Coimbra, Coimbra, Portugal – September

ROCHA, Luís

biosocial complexity in human health: from biochemical control to social factors in DDI and reproduction Frontières du Vivant PhD Programme Sorbonne Paris University, Sesimbra, Portugal – June

Towards understanding

SOARES, Miguel P.

Heme regulation of glucose metabolism in bloodstream infection

Institut Pasteur Advanced Immunology Course 2018–2019, Paris, France – December

SOUSA, Ana Laura

Introduction to Electron Microscopy

Methods for Biosciences, ITQB, Oeiras, Portugal – January

XAVIER, Karina B.

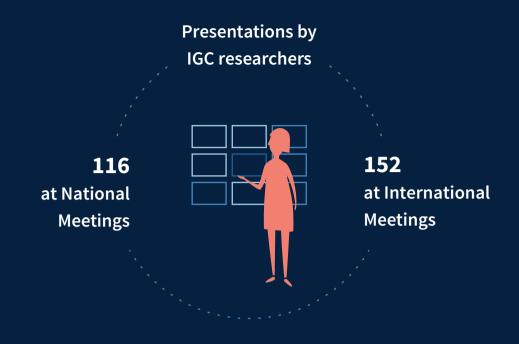
Introduction to the concept of Bacterial Communities – Quorum Sensing and Chemical Communication in Bacteria" and "Bacterial communities inside our bodies

MolBioS–ITQB PhD Programme, Universidade Nova de Lisboa, Oeiras – April

Bacterial intercellular communication in the mammalian gut

Programa de Doutoramento em Ciências da Saúde da Faculdade de Medicina da Universidade de Coimbra, Coimbra – November









39Meetings, Conferences and Workshops organised by IGC scientists

SEMINARS & MEETINGS

Seminars at the IGC 2018

January

05.01

The genetic and epigenetic secrets of success of an invasive vertebrate

Irene Adrian-Kalchhauser University of Basel

09.01

Investigating the function of an EMT factor in Glioblastoma

Diogo Castro IGC

11.01

Rat and mouse genome engineering with CRISPR/ Cas9: the Phenomin – ICS experience

Marie-Christine Birling Institut Clinique de la Souris, France

12.01

Dual mode strigolactone signalling and the bud activation switch

Ottoline Leyser University of Cambridge, UK

16.01

Evolutionary self-organisation: lessons from the polarisation machinery in budding yeast

Liedewij Laan Kavli Institute of NanoScience, The Netherlands

19.01

How do plants manage their carbon? Elena Baena González IGC 23.01

Posttranscriptional control of stress responses during early plant growth Paula Duque

Paula Duque IGC

25.01

God does not play dice. What about mealybugs? Sergio López Madrigal University of Valencia, Spain

26.01

Healthy and malignant haematopoiesis in the bone marrow: active cells in a dynamic environment Cristina Lo Celso Imperial College London, UK

30.01

Homeostasis perturbations: In sickness and in health Luis Moita IGC

February

02.02

Peptidoglycan synthesis drives FtsZ treadmillingindependent step of cytokinesis

Mariana Pinho Instituto de Tecnologia Química e Biológica, Portugal

09.02

Genomics of eco-evolutionary dynamics

Philine Feulner
Eawag – Swiss Federal Institute of Aquatic Science and Technology, Switzerland 15.02

Mechanisms of Selective Autophagy

Sascha Martens

Max F. Perutz Laboratories, University of Vienna, Austria

16.02

From Onco to Neuro: unantecipated findings on tissue-resident gamma-delta T cells

Bruno Silva Santos Instituto de Medicina Molecular, Portugal

20.02

Keeping genes on, keeping genes off

Lars Jansen IGC

21.02

Coincidental evolution in the human susceptibility to infection by Vibrio parahaemolyticus Carlos Blondel

Universidad Autónoma de Chile, Chile

21.02

Bacterial war and love in the time of choleraí – How neighbor predation fosters horizontal gene transfer in Vibrio cholerae

Melanie Blokesch Swiss Federal Institute of Technology Lausanne (EPFL), Switzerland

22.02

From so simple a beginning: Adaptation and

diversification in microbial populations

Rees Kassen Faculty of Science, University of Ottawa, Canada

23.02

Watching the developmental onset of genomic imprinting

Patrick O'Farrell University of California, USA

27.02

A cross-talk between iron and glucose metabolism that establishes disease tolerance to infection Miguel Soares IGC

27.02

Recombining your way out of trouble: Adaptation through hybridization Rike Stelkens Stockholm University, Sweden

March

01.03

Dating the Emergence and Spread of Antimicrobial Resistance Mutations François Balloux University College London, UK

01.03

Evolutionary dynamics of transposable elements in vertebrate genomes Stéphane Boissinot New York University, Abu Dhabi, United Arab Emirates

02.03

Telomeric chromatin analysis: insights into damage protection

Joachim Lingner École Polytechnique Fédérale de Lausanne, EPFL, Switerland

06.03

Hybridization on rugged fitness landscapes

Claudia Bank IGC

09.03

Genome fragmentation in endosymbionts: good, bad, or just ugly?

John McCutcheon University of Montana, USA

13.03

What do IRG proteins (Immunity- related GTPases) actually do? Jonathan Howard IGC

14.03

See more with the Fluidigm C1 system: explore the breadth of applications available on the C1 platform for single-cell genomics

Jordan Moore Fluidigm Corporation, EUA

16.03

Innate lymphoid cells and the second brain

Henrique Veiga Fernandes Fundação Champalimaud, Portugal

20.03

Gluing chromosomes: What for and how much Raquel Oliveira IGC

20.03

Impact of the *Escherichia* coli translational capacity on the genome stability

Ivan Matic

Institut National de la Santé et de la Recherche Médicale, France

23.03

Gene regulatory interactions underlying neural crest development and evolution

Marianne Bronner California Institute of Technology, USA 26.03

Unravelling heme salvage mechanisms in trypanosomatid parasites to fight neglected tropical diseases José M. Pérez-Victoria

Instituto de Parasitología y Biomedicina, Spain

27.03

My name is Legion, for we are many: a quantitative inquiry into somatic variation in multicellular individuals

Jorge Carneiro IGC

April

06.04

mTOR and Lysosomes in Growth Control

David Sabatini Whitehead Institute for Biomedical Research, USA

10.04

T-cell regulation in Systemic Lupus Erythematosus Constantin Fesel IGC

11.04

Innovative publishing for the good of science with ScienceMatters

Amani Said ScienceMatters AG, Switzerland

13.04

Applying Koch's postulates to beneficial members of the microbiota

Bärbel Stecher Ludwig – Maximilians University, Germany

13.04

The dynamics of molecular evolution over 60,000 generations

Benjamin Good University of California, USA

Transcriptional control of myeloid cells in inflammation

Irina Udalova

The Kennedy Institute of Rheumatology, University of Oxford, UK

17.04

Interspecies Quorum Sensing in the Mammalian Gut Microbiota

Karina Xavier IGC

17.04

Connected instability of T-cell regulation and homeostasis in systemic lupus erythematosus

Constantin Fesel IGC 18.04

Control of Pathogen Colonization by Immunity and the Microbiota

Gabriel Núñez

Department of Pathology and Comprehensive Cancer Center, University of Michigan Ann Arbor, USA

18.04

A complete overview of single cell technology

Juliane Fischer/ Paul Oakley Dolomite Micro/Bio, UK

18.04

Ssu72 phosphatase terminates the cycle of telomere replication

Edison Carvalho IGC 20.04

The 10x Genomics Chromium System: Revolutionizing Gene Expression

Chiara Reggio
10x Genomics, USA

20.04

Role of the microbiota in the defense against resistant pathogens

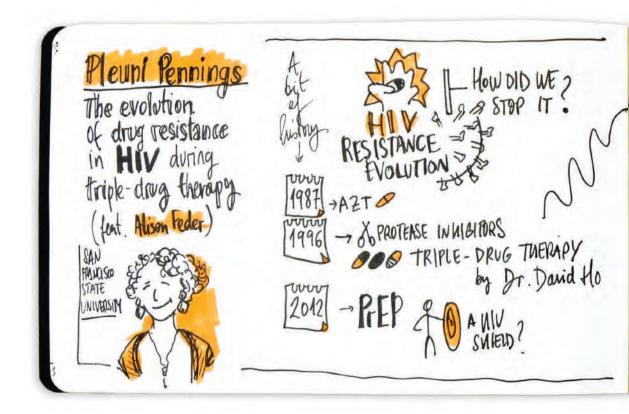
Carles Ubeda

Fisabio – GVA, Spain

26.04

Novel insights into microbial evolution and ecology through large-scale simulations of the evolution of metabolism and microbiome data analysis

João Rodrigues University of Zurich, Switzerland



Drug resistance evolution in HIV: why it happened but is not happening anymore Pleuni Pennings San Francisco State University, USA

May

04.05

Mechanisms underlying the benefits of dietary fibers in metabolic control Gilles Mithieux Lyon University, France

08.05

The Regulation of Centrosome Biogenesis Mónica Bettencourt Dias IGC 11.05

Concordance versus discord among species: lessons on abiotic versus biotic factors shaping species divergence Lacey Knowles University of Michigan, USA

15.05

Mechanisms of Influenza A Virus Modulation of Host Membrane Trafficking Maria João Amorim IGC

18.05

Single-molecule imaging of transcription at damaged chromatin Sérgio de Almeida Instituto de Medicina Molecular, Portugal 22.05

Dissecting heterogeneity: from patterns to processes with mathematical models Erida Gjini IGC

Comparative genomics

of wild populations of

23.05

Legionella bacteria, an emerging pathogen in the Iberian Peninsula Linda Amaral Zettler Fulbright Portugal Scholar from the Woods Hole Marine

25.05

Drivers and consequences of microbe-mediated protection from infection Kayla King University of Oxford, UK

Biological Laboratory, EUA



Combining Microscopy and Flow Cytometry - Imaging Flow Cytometry systems and applications

Carlo Raviolo Merck, Portugal

29.05

Two tales from the injured liver: CD26 and TREM2 control macrophage responses to hepatotoxic damage

Carlos Penha-Gonçalves IGC

June

01.06

From genes to fitness: How much of evolution can we predict? Lília Perfeito IGC 05.06

The different lives of the axial progenitors, the builders of the vertebrate body Moisés Mallo IGC

05.06

Nanobodies as versatile tools to investigate the cell biology of the innate immune system

Florian Schmidt University of Bonn, Germany

08.06

The genomic substrate for adaptive radiation in Lake Tanganyika cichlid fishes Walter Salzburger University of Basel, Switzerland

12.06

Epistasis and the Fate Resistant Bacteria Across **Environments**

Isabel Gordo IGC

15.06

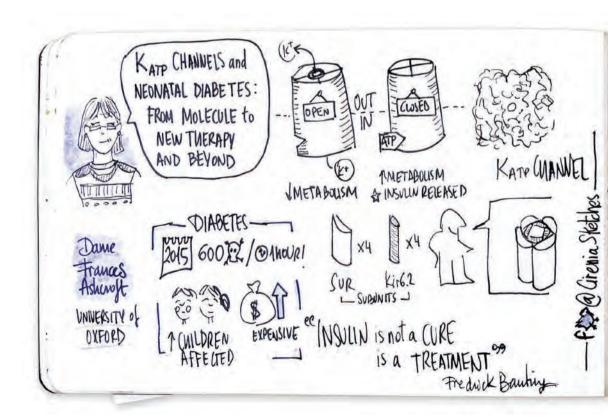
KATP channels and neonatal diabetes: from molecule to new therapy and beyond Frances Ashcroft University of Oxford, UK

19.06

Viral modulation of host immunity and cell biology Michael Parkhouse IGC

22.06

The Spindle Assembly Checkpoint: With Great Power Comes Great Responsiveness Jonathon Pines The Institute of Cancer Research, UK



Do short telomeres create a wound that does not heal? Miguel Godinho Ferreira IGC

29.06

Bivalent roles of Vav family oncoproteins as tumor promoters and suppressors Xosé Bustelo

Cancer Research Center, CSIC

– University of Salamanca,
Spain

July

03.07

Will we ever explain interindividual heterogeneity: the case of autoimmunity Jocelyne Demengeot IGC 03.07

Making the retina: The interplay of single cell biology and tissue-wide phenomena Caren Norden

MPI of Molecular Cell Biology and Genetics, Germany

05.07

Come and learn about the StartUp research program that is available for IGC researchers!

Miguel Santos Instituto de Tecnologia Química e Biológica, Portugal

06.07

New synaptic communication strategies for immune cells

Michael Dustin

The Kennedy Institute of Rheumatology, University of Oxford, UK

09.07

Critical role of CD4+ T cells and IFNg signalling in antibody-mediated resistance to Zika-virus infection

Marcelo Torres Bozza Universidade Federal do Rio de Janeiro, Brazil

10.07

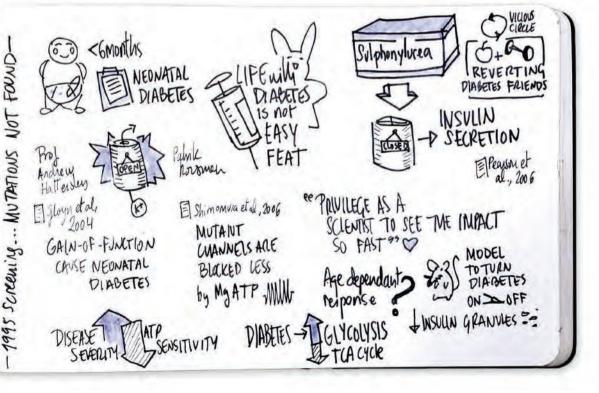
Chasing the elusive origins of novel enhancers Élio Sucena IGC

12.07

Close encounters of the first kind: how chromosomes capture microtubules in mitosis

Geert Kops

Hubrecht Institute – KNAW and UMC Utrecht, Netherlands



Controlling microtubule functions with the tubulin code

Carsten Janke Institut Curie, France

13.07

The consequence of aneuploidy in human cells: dynamic genome, dynamic proteome

Zuzana Stocheva Faculty of Biology, Technical University Kaiserslautern, Germany

13.07

Understanding the macroevolutionary consequences of past environmental changes and species interactions

Hélène Morlon Institute of Biology at the École Normale Superieure in Paris, France

13.07

Custom micropatterning for cell control demo

Mehmet Deniz Akyüz Alvéole, Business Development Manager Europe

20.07

Oxidative stress in cells with extra centrosomes drives non-cell autonomous invasion

Susana Godinho Barts Cancer Institute, Queen Mary University of London, UK

24.07

The microtubule massacre Manuel Thery CEA, Hospital Saint Louis, France

25.07

Mechanisms that drive rapid genome evolution

David Pellman Dan–Farber Cancer Institute, USA

August

10.08

Role of microbiota and T-cell receptor in intestinal T cell plasticity

Angelina Bilate Laboratory of Mucosal Immunology. Rockefeller University, New

29.08

Intra-genomic conflicts and demography drive the evolution of genome size and structure in vertebrates Stéphane Boissinot New York University, United Arab Emirates



September

03.09

Metabolic Dependencies and Drug Interactions of the Human Gut Microbiome Kiran Raosaheb Patil European Molecular Biology

Laboratory, Germany

04.09

Understanding *Drosophila* syncytial development from the perspectives of material properties and active intracellular organizers

Ivo Telley
IGC

06.09

Exploring the stem cell genome: chromatin regulation and genomic instability
Allisson Bardin
Institut Curie, France

10.09

EU-LIFE initiatives on research organization and science policy: an update Marta Agostinho EU-LIFE

11.09

Drosophila melanogaster gut microbiota

Luis Teixeira IGC

11.09

How accessory subunits change the physiological function of a key potassium channel

Rene Barro Soria Department of Medicine, University of Miami, USA

11.09

The pericyte of the pancreatic islet: an ignored player in islet biology Joana Almaça Department of Medicine, University of Miami. USA

14.09

Transcription factor-mediated gene positioning at the nuclear periphery regulates transcription and epigenetic states

Jason Brickner Northwestern University, USA

18.09

Cell competition in the thymus and Leukemia Vera Martins, IGC

18.09

Molecular Sex: How Sperm Binds to the Egg at the Atomic Level

Luca Jovine Karolinska Institutet, Sweden



Understanding the possible roles of microtubule regulation in ageing and neurodegenerative diseases

Pilar Okenve-Ramos Institute of Translational Medicine. UK

21.09

Mutant p53 activities in somatic and germline mouse tumor models

Guillermina Lozano The University of Texas MD Anderson Cancer Center, USA

24.09

The battle of the sexes

David Hosken Dean Strategic Development,

Cornwall University of Exeter, UK

24.09

Ribonomics approaches to decipher posttranscriptional networks in *Arabidopsis* Dorothee Staiger University of Bielefeld, Germa-

ny 25.09

Parallel adaptation of rabbit populations to myxoma virus

Frank Jiggins University of Cambridge, UK

28.09

Virus defense at the brain border

Ulrich Kalinke Institut für Experimentelle Infektionsforschung, Germany

October

02.10

Regulation and pathophysiological roles of the proteolysis on the cell surface Colin Adrain IGC 09.10

Get to know your facilities: EM and Genomics

Erin Tranfield / Jorg Becker IGC

11.10

Discovery of novel mechanisms of centrosome clustering and their therapeutic value in cancer

Nora Fresmann Instituto de Medicina Molecular, Portugal

12.10

Finding a Niche: Microbial Colonization of Host Mucosal Barriers Katharina Ribbeck Harvard University, USA

17.10

Making a single product per cell: lessons from V(D)J recombination and X chromosome inactivation Delphine Pessoa

IGC 19.10

Cooperation and Conflict in the Social Amoeba

Elizabeth Ostrowski Massey University Auckland, New Zealand

23.10

Redundancy In Social Contact Networks for Epidemic Spread Models and in the Control of Biochemical Regulation Luís Rocha

IGC

25.10

Integrin signaling drives functional nanoclustering of plasma membrane components via cortical acto-myosin activity Thomas S. Van Zanten

Thomas S. Van Zanten National Centre for Biological Sciences, India 26.10

A network approach to the study of comorbidity

Alfonso Valencia Barcelona Supercomputing Centre, Spain

31.10

Serrapilheira Institute: promoting scientific excellence in Brazil Hugo Aguilaniu

Instituto Serrapilheira, Brazil

November

02.11

Taking your lungs to the Moon – and maybe Mars Kim Prisk University of California, USA

05.11

The role of Keratins in modulating carcinogenesis via communication with cells of the immune system Inês Sequeira Centre for Stem Cells & Regen-

Centre for Stem Cells & Regenerative Medicine, King's College London, UK

06.11

Cell autonomous and noncell autonomous roles of telomerase in cancer Miguel Ferreira IGC

07.11

Effects of the good, the bad and the ugly (diets) on the evolution of Bacteroides thetaiotaomicron Tanja Dapa

IGC

09.11

Actively frozen: contextual modulation of defensive response and its neuronal basis

Marta Moita Fundação Champalimaud, Portugal

195

13.11

From public understanding of science to political communication: how do we choose what to believe in?

Joana Gonçalves-Sá

IGC

16.11

The problem of not being good whiskeyÖ IL-7 and IL-7R in T-cell leukemia

João Barata Instituto de Medicina Molecular. Portugal

21.11

Horizontal gene transfer overrides mutation in Escherichia coli colonizing the mammalian gut Nelson Frazão IGC

23.11

ERK signalling orchestrates neural differentiation by promoting the polycomb repressive complex Kate Storey

Kate Storey School of Life Sciences, University of Dundee, UK

27.11

The Shortest Path between Immune-inspired Spam Detection, Filmmaking and A.I. – Generated Art Alaa Abi-Haidar

Paris

Rare variants of strong effect in autoimmune disease Íris Caramalho IGC

30.11

Mitotic Inheritance of Transcriptional Networks in Vertebrate Neurogenesis Diogo Castro IGC

December

04.12

Heterogeneous expression in isomorphic sperm cells? Jörg Becker IGC

05.12

An evolutionary approach to the study of social cognition – co-starring zebrafish and fruit flies

Susana Varela IGC

07.12

New Therapeutic Concept Discovery and Target ID in Oncology

Mark Paul Petronczki Cancer Cell Signaling at Boehringer Ingelheim, Austria

07.12

Career Path Section with Mark Petronczki

Mark Paul Petronczki Cancer Cell Signaling at Boehringer Ingelheim, Austria

11.12

Mechanisms of social cognition in zebrafish: from molecules to behavior and back Rui Oliveira IGC

12.12

The cause of the cost and the cost of the cause Roberto Balbontín IGC

14 12

Bee behaviour in a changing world

Elli Leadbeater School of Biological Sciences, Royal Holloway University of London, UK

19.12

Crystal structure of
Exuperantia – from nurse
cells to oocyte
Diana Vieira
IGC

20.12

Resolving the spatiotemporal map of the tight junction interactome during epithelial polarization

Karina Pombo-Garcia Max Planck Institute of Molecular Cell Biology and Genetics (MPI–CBG)

21.12

Well-being at work in academia

Gabriel Marais Laboratoire de Biométrie et Biologie Evolutive, Université Claude Bernard Lyon

Meetings, Conferences & Workshops 2018

January

JANUARY 18

Mini-Symposium between the LANN (Tu Delft) and Bank Labs

This meeting took place to exchange ideas and present ongoing projects regarding fitness land-scapes and experimental evolution approaches (20 attendees).

Organiser: Claudia Bank (IGC)

IGC, Oeiras, Portugal

JANUARY 27-FEBRUARY 2

Training School 06 for Early Carrer Investigators

Organiser: Gabriel G. Martins (IGC)

Sponsors: NEUBIAS COST Action #CA15124

and BRC, Hungarian Academy of Sciences.

Szeged, Hungary

February

FEBRUARY 18-20

1st HHMI International Research Scholar Meeting

The first meeting of the HHMI International Research Scholars brought together 36 scientists who were selected last year for this programme, to informally present their projects. In total, 55 people participated in this meeting.

Organisers: Jonathan Howard, Liliana Rodrigues and Cláudia Campos (IGC).

Sponsors: Fundação Calouste Gulbenkian (FCG) Fundação Calouste Gulbenkian (FCG)

FEBRUARY 23-26

Annual Consortium Meeting for Predicting the Persistence of Resistance Across Environments (PREPARE)

Meeting with PREPARE project collaborators to present ongoing work and discuss future directions regarding fitness landscapes of antibiotic resistance across environments (16 attendees).

Organiser: Claudia Bank (IGC)

Convento da Arrábida, Setúbal, Portugal

March

MONTHLY

Micro-Workshop on Image Analysis

Bioimage analysis and macros with ImageJ. Organiser: Gabriel G. Martins (IGC) IGC, Oeiras, Portugal

MARCH 2

2nd Annual Meeting of PIC – Interface à Ciência: Adicionar Valor ao Conhecimento

"Interface to Science: adding value to knowledge" is the second meeting of managers, communicators and other professionals involved in the areas of interface to science in Portugal. Organized by the *Plataforma de Interface à Ciência*, the event aimed to reflect on these interface areas and their contribution to the development of the national Research and Innovation (I & I) system. The program included a lecture on alternative proposals to the current system of research funding by Johan Bollen, Indiana University, followed by a debate with the participation of representatives of different entities of the national R&I system.

Organisers: PIC – "Plataforma de Interface à Ciência"; Sheila Vidal (IGC).

Sponsors: Secretaria de Estado da Ciência, Tecnologia e Ensino Superior + FCT.
Teatro Thalia, Lisbon, Portugal

MARCH 26-28

ImageJ/Fiji Micro-Workshop "Introduction to Image Processing and Analysis"

First seminar of a series being organised by the UIC: Advanced Imaging team in 2018 for new users that aim to learn the basics of image analysis and processing, which covered the basics of

ImageJ/Fiji interface and usage, image filtering and enhancement, creating and processing image masks, working with pixels and objects and exploring some techniques for analysis and feature extraction.

Organiser: UIC – Advanced Imaging team (IGC) Coimbra, Portugal

April

APRIL 10

RFA Unit Welcome Info

These informative session aims at informing postdocs who have recently joined the IGC (last 3-6 months) about the services and tools provided by the RFA Unit. A total of 7 postdoctoral fellows attended this seminar.

Organiser: RFA Unit IGC, Oeiras, Portugal

APRIL 12

Social Media Workshop

This one-day workshop was designed to introduce scientists from Institute of Social Sciences from University of Lisbon (ICS) to social media, helping them to identify best channels to promote their work, connect with other scientists and be an active communicator, voicing their opinion on scientific issues that might matter to society. Twenty researchers attended the workshop.

Organisers: Inês Domingues (IGC)

Institute of Social Sciences, University of Lisbon

APRIL 13

Social Media Workshop

This one-day workshop was designed to introduce IGC researchers to social media, helping them to identify best channels to promote their work, connect with other scientists and be an active communicator, voicing their opinion on scientific issues that might matter to society. Twenty researchers attended the workshop.

Organiser: Inês Domingues (IGC) IGC, Oeiras, Portugal

May

MAY 1-6

EMBO Workshop: Telomere biology in Health and Human Disease

This EMBO Workshop focused on the molecular mechanisms of telomere biology and how this is

compromised in human genetic disorders, ageing and cancer. The principle themes of the meeting addressed the latest advances in telomere function and regulation and how this can be exploited for diagnostics, anti-cancer approaches and treatment/ management of telomere dysfunction disorders. A major objective of the meeting was to provide a forum for open and stimulating discussions between key basic, translational and clinical scientists and young researchers who have recently joined the field. Total number of participants was 255.

Organisers: Miguel Godinho Ferreira (IGC), Claus Azzalin (Instituto de Medicina Molecular), Simon Boulton (The Francis Crick Institute), Raymund Wellinger (Université de Sherbrooke)

Sponsors: The Embo Journal, EmboPress, Instituto Gulbenkian de Ciência, Febs Letters, Artios, The Company of Biologists, Visit Portugal – Turismo de Portugal, Turismo de Portugal – Alentejo, Fundação para a Ciência e a tecnologia, Instituto de Medicina Molecular – João Lobo Antunes, International Journal of Molecular Sciences, Addgene. Tróia, Portugal

MAY 2-4

Oneida Workshop

A Practical workshop on high throughput sequencing data analysis.

Organisers: João Carriço, Daniel Sobral and Pedro Fernandes (IGC).

IGC, Oeiras, Portugal

MAY 7-11

Elixir-Excelerate Workshop on marine Metagenomics

A Practical workshop on metagenomics data analysis.

Organisers: Daniel Sobral (IGC), Pedro Fernandes (IGC) and Nils Willassen (UiT, Norway). IGC, Oeiras, Portugal

MAY 19-20

XXII Meeting Portuguese Society Animal Pathology

Organiser: Pedro Faísca (IGC) Coimbra, Portugal

June

IIINE 5

Primate Conservation Genetics

Within the scope of the Primatomics project, a collaboration has been established with Gola Rain-

forest National Park, Sierra Leone, with the goal of studying some of its most emblematic species – western chimpanzee, western red colobus, western black-and-white colobus. The workshop aimed at, not only introducing the project to the Sierra Leonean conservation and research community, but also discussing the technical advances in Conservation Genetics and Genomics and providing a hands-on experience in Conservation Genetics methods. Among Professors, students, and staff from different conservation entities, roughly 50 people attended the workshop.

Organisers: Tânia Minhós (IGC), Isa A. Pais (Cardiff University and Universidade Nova de Lisboa), Filipa Borges (IGC).

Sponsor: Primatomics project Njala University, Sierra Leone

JUNE 20-23

EMBO Workshop "New Shores in Land Plant Evolution"

This EMBO workshop focused on the development and dissemination of resources for a growing community of researchers interested in this topic. It included not only new development in research in bryophytes but also seminal studies in orphan groups of land plants' ancestors such as characeans, zygnemataceans and more ancestral species of unicellular algae. It hosted 165 participants from 24 countries (http://meetings.embo.org/event/18-plant-evo).

Organisers: Jörg Becker (IGC) and Fred Berger (GMI Vienna).

Sponsors: EMBO, Aralab, Rhenac GreenTec, ILC, Society for Experimental Biology.

Fundação Calouste Gulbenkian, Lisboa, Portugal

JULY 30-JULY 8

EMBO Pratical Course on 3D Developmental Imaging

This EMBO Practical Course was aimed at junior researchers in developmental biology, struggling with imaging of cell movement and tissue morphogenesis *in vivo* using conventional microscopy techniques. Exploring techniques such as confocal, two-photon, light-sheet, and optical tomography with different samples was a major feature of the course. Several commercial partners contributed with state-of-the-art equipment for students to use during the course.

Organisers: Gabriel Martins, Nuno P. Martins, Hugo Pereira, Nuno Moreno and José Feijó. Sponsors: EMBO, LaVisionBioTac, LusoPalex, IGC, CellExplorerLabs, PPBI, SVI, Andor, Luxendo, GE, Olympus, SunJinLab, Bitplane, Agendo, Leica, Zeiss.

IGC, Oeiras, Portugal

JUNE AND JULY

Citizen Forum: What Conditions Should Portugal Offer to Arriving Migrants?

Randomly selected citizens (50) listened to experts and deliberated on relevant issues.

Organisers: Joana Gonçalves de Sá and Paulo Almeida (IGC); Citizen's Forum; Teatro Maria Matos.

Teatro Maria Matos, Lisbon, Portugal

July

JULY 19-20

Workshop on Biophysical Constraints and Evolutionary Cell Biology

All evolutionary changes begin with alterations at the cellular level. Biophysical cues dictate cellular adaptation to the environment and regulate fundamental biological processes, such as cell differentiation, proliferation, polarity and motility at the single and collective cell level. Given that cells have been discovered by Robert Hooke in 1665, it is remarkable how little we know on the macro and micro-environmental constraints that have shaped the evolution of cells. Ancestral evolutionary biophysical constraints may well limit cellular function and survival during homeostasis and disease. The workshop "Biophysical Constraints and Evolutionary Cell Biology" addressed this contemporary issue of Biology for 20 participants (and 10 speakers).

Organisers: Cláudio Franco (IMM) and Mónica Bettencourt-Dias (IGC).

Sponsors: Instituto Gulbenkian de Ciência, Instituto de Medicina Molecular João Lobo Antunes and Research Tumor Biology.

IGC, Oeiras, Portugal

JULY 23-27

Logical Modelling of (Multi)Cellular Networks

Mini-symposium of the 11th European Conference on Mathematical and Theoretical Biology. Boolean and multilevel logical approaches are increasingly used to study the behaviours of biological regulatory networks. Modellers can rely on a broad array of model definitions, simulation methods, computational algorithms and software tools. This mini-symposium aimed at introducing

these modelling approaches and discussing recent advances on both formal aspects and applications. It was organized in connection with the Consortium for Logical Modelling and Tools (CoLoMoTo, http://colomoto.org). An overview of the field was presented, and four speakers presented their recent achievements to approximately 40 attendees. Organisers: Claudine Chaouiya (IGC) and Pedro Monteiro (IGC and IST).

Lisboa, Portugal

August

AUGUST 21

The Theory of Fitness Landscape: Where is this path taking us? – Symposium at Evolution/ESEB 2018

The aim of the symposium was to emphasize how different biological questions in different biological fields (speciation, antibiotic resistance, protein evolution) are addressed using a similar approach: fitness landscapes. This conference had 2700 attendees.

Organisers: Claudia Bank, Alexandre Blanckaert, Inês Fragata (IGC).

Montpellier, France

September

SEPTEMBER 8-9

Drosophila Portuguese Meeting

Annual scientific meeting with the Portuguese scientific community that uses *Drosophila melanogaster* as a model system, as well as internationally renowned invited speakers. This meeting was attended by 71 scientists.

Organisers: Pedro Domingos (ITQB), Christa Rhiner (CCU), Luis Teixeira (IGC), Rita Valente (IGC).

Sponsors: The company of Biologists; Filsat; Best Gene; Nzytech; Instituto Politécnico de Tomar; ThermoFischer Scientific; The FEBS Journal; LabOrders.

Tomar, Portugal

SEPTEMBER 13-15

25 Years of IGC's PhD Programmes

The year of 2018 marks 25 years since the launching of the first PhD Program at the IGC and associated institutions. A 3-days meeting was held at the Calouste Gulbenkian Foundation, Champalimaud Foundation and Instituto Gulbenkian

de Ciência, to discuss science, graduate education and institutional policies. This meeting hosted around 300 IGC alumni.

Organisers: António Coutinho (IGC and Champalimaud Foundation), Greta Martins (IGC).

Sponsors: Calouste Gulbenkian Foundation; Champalimaud Foundation.

Calouste Gulbenkian Foundation, Champalimaud Foundation, IGC, Portugal

SEPTEMBER 26 - 28

Mosstech "Idea to Product Course"

This course had 20 participants.

Organisers: Jörg Becker (IGC) and Henrik Toft Simonsen (DTU Copenhagen).

IGC, Oeiras, Portugal

October

OCTOBER 1-4

IGC/Congento Pratical Course on Laboratory Animal Science in Mice and Zebrafish

Under the scope of Laboratory Animal Science Courses, this course fulfils a legal requirement for researchers and technicians working with laboratory animals. Following recent recommendations by FELASA 2015, enrolment in species-specific modules was possible in this course and contents were harmonized with other courses provided by other Institutions taking part of CONGENTO FCT Roadmaps National Research Infrastructure along with IGC. The number of participants was 32 and included external students from other Institutes. namely, CEDOC, ITQB, FFUL and FCUL. Core faculty included 2 invited teachers and 18 IGC members (5 researchers and 13 Facilities staff, not only from the AHF but also from the Biosafety. and Communication & Outreach, all with teaching experience). This course is integrated in the IGC PhD Program since 2015. The theoretical part of the course was done through an e-learning system, provided by the Sociedade Portuguesa de Ciências de Animais de Laboratório - SPCAL.

Organiser: Animal House Facility (IGC) Sponsors: IGC, Ultragene, Lusopalex. IGC, Oeiras, Portugal

OCTOBER 11

Congento Annual Meeting

The 1st Congento Annual Meeting gathered 47 participants amongst managers, specialized technicians, animal care staff, veterinarians, and researchers from different backgrounds and

different institutes, sharing the same interest in developing a comprehensive infrastructure to support research using genetically tractable organisms. The meeting included talks to present some of the work developed in the facilities, creating an opportunity to share knowledge and to discuss new synergies. The 4 working groups also presented the work developed during the first year of the project. The event had the participation of Lluis Montoliu, an invited speaker from CSIC, Madrid, who presented his view regarding animal experimentation and genome editing, with a focus on applications, challenges, and transparency.

Organisers: Jocelyne Demengeot and Animal House Facility (IGC).

Sponsors: Instituto Gulbenkian de Ciência, Fisher Scientific, IDEXX, Laborspirit, Lusopalex, ORM, Ultragene, World Courier, Zeiss. IGC, Oeiras, Portugal

OCTOBER 11-12

ENBE 2018, XIV Encontro Nacional de Biologia Evolutiva

The Portuguese annual meeting for evolutionary biology had 92 participants.

Co-organiser: Inês Fragata

Museu Nacional de História Natural e da Ciência, Portugal

OCTOBER 16-19

Trainning School 08 for Early Career Investigators, and TS09 for Facility Staff

Organiser: Gabriel G. Martins

Sponsors: NEUBIAS COST Action #CA15124,

Univ. Edinburg and Univ. Dundee.

Edinburgh, UK

OCTOBER 19

RFA Unit Welcome Info

These informative session aims at informing post-docs who have recently joined the IGC (last 3-6 months) about the services and tools provided by the RFA Unit. A total of 7 postdoctoral fellows attended this seminar.

Organiser: RFA Unit (IGC) IGC, Oeiras, Portugal

OCTOBER 20-26

African Science Week

Series of activities on science promotion, education, and outreach, happening simultaneously in more than 30 African countries, supported by the Next Einstein Forum. More than 150 participants attended the main conference, and poten-

tially thousands were reached through 5 daily radio shows.

Organisers: Sara Baptista (IMM), Yara Rodrigues (IGC), Joana Goncalves-Sá (IGC).

Sponsors: Calouste Gulbenkian Foundation, IGC, Instituto Camões, KM7, Oásis Atlântico. Cabo Verde

OCTOBER 22-24

Microbial Eco-Evolutionary Dynamics Symposium

This meeting aimed to discuss recent developments in microbial eco-evolutionary dynamics research and serve as a venue for integrating the results obtained from different fields of evolution and ecology. It brough together experts on different aspects of microbial evolution and ecology (e.g. experimental evolution, comparative genomics, ecological interactions, and theoretical biology): 110 registered participants, 9 invited talks, 20 contributed talks, 55 posters.

Organisers: Ricardo Ramiro, Hugo Barreto, Tanja Dapa, Hermina Ghenu, and Inês Fragata (IGC). Sponsors: IGC, Oeiras Municipality, EMBO, The Company of Biologists, Innova Scientific, eLife, Paperpile, PeerJ, FEBS letters.

IGC, Oeiras, Portugal

OCTOBER 22-25

Tirana Mathematical and Computational Biology Workshop

The 1st Mathematical and Computational Biol-Workshop (www.tiranamathbio2018.com) united local students and researchers. This event was held in the framework of 2018 as the Year of Mathematical Biology, announced by the European Mathematical Society, to promote the importance of mathematics in biology and medicine. The workshop was the first scientific event in this field to be held in Albania and welcomed more than 80 participants across 4 days. These included a majority of Master and PhD students, and lecturers from the Department of Mathematics and Physics, Faculty of Natural Sciences, University of Tirana, Albania, and the remainder coming from the University of Medicine, the Department of Biology, the Institute of Public Health and Institute for Food Safety and Veterinary Sciences. The Workshop comprised an intense 3-day program, alternating lectures and advanced seminars in mathematical epidemiology, ecology, and medicine of cancer and cardiovascular disease. International lecturers were invited from France,

Portugal and the UK.

Organisers: Erida Gjini (IGC), Albanian Academy of Sciences.

Sponsors: The Company of Biologists (UK), Society for Mathematical Biology (USA).

Albanian National Academy of Sciences, Tirana, Albania

OCTOBER 25-26

3D Print, Micro-Controllers Programming, and Robotics

Workshop for undergraduate students in Cabo Verde under the Africa Science Week initiative. Organisers: Nuno Moreno (IGC), Tiago Vale (IGC), João Frazão (Champalimaud Foundation). Cabo Verde

OCTOBER 30

How to Improve Current Science Funding

The proponents of the Manifesto Ciência 2018 started organising a series of conferences to discuss the Portuguese scientific system. This was the first conference on building and maintaining a sustainable science ecosystem. It started with a presentation about the OCDE view, followed by several presentations. Approximately 150 attendees *in loco* and potentially hundreds more via online streaming.

Organisers: Joana Gonçalves-Sá and Mónica Bettencourt Dias.

Calouste Gulbenkian Foundation, Lisbon, Portugal

November

MONTHLY

Necropsy Workshop with a Special Twist on Immunity & Infection

Organiser: Pedro Faísca IMM, Lisbon, Portugal

NOVEMBER 7-10

Joint Meeting of the Portuguese, Spanish and French Societies for Developmental Biology

Hosted by the Portuguese Society of Developmental Biology (SPBD), it had 165 attendees.

Co-organisers: Diogo Castro (IGC), Leonor Saúde (IMM), Solveig Thorsteinsdottir (FCUL) and Ana Ribeiro (IMM).

Sponsors: Company of Biologists (CoB), International Society for Developmental Biology (ISDB), International Society for Developmental Neuro-

science (ISDN) and International Society of Differentiation (ISD).

Porto, Portugal

NOVEMBER 12-16

2nd FLXFLOW Course: Principles and Applications of Flow Cytometry

This course received more than 70 attendees from academic and non-academic institutions of Portugal and all across Europe. It consisted on more than 30 hours of theoretical talks, workshops, technical seminars and a whole day of hands-on practice, covering basic to advanced topics of Flow Cytometry. Faculty included highly recognized speakers in the field, Rui Gardner from the Memorial Sloan Kettering Cancer Center, USA: Tim Bushnell, from the University of Rochester Medical Center, USA; and Claudia Dumrese from the University of Zurich; in addition to other national and international speakers and the organizers. The course had two social events to promote informal discussions amongst participants and the speakers and to facilitate networking.

Organisers: FLxFlow network: Flow Cytometry facilities from Instituto Gulbenkian de Ciência, Instituto de Medicina Molecular, Champalimaud Foundation and CEDOC – Chronic Diseases Research Center.

Sponsors: FlowJo, Enzifarma/BD Biosciences, Cytek, SYSMEX, Beckman Coulter, Sony/Izasa, Miltenyi Biotec, Merck, CYTOGNOS, LabClinics, Lusopalex, Immunostep and Cirklo.

IGC. Oeiras, Portugal

NOVEMBER 23-DECEMBER 14

Workshop Advice and Tips to Improve your CV Under the Scope of the "Postdoctoral Workshop Series: Skills and Tools to Improve your Career"

This workshop's aim is to provide advices and tips in a practical setting to help young researchers to compose a more effective and tailored scientific CV. A scientific *curriculum vita* is the most common communication tool used to self-marketing expertise when applying for academic/ research jobs, fellowships or grants. A total of 12 participants attended this workshop (5 postdocs, 4 PhD students, 2 technicians, 1 training assistant).

Twenty researchers attended the workshop.

Organiser: RFA Unit & IGC Postdoctoral Committee

IGC, Oeiras, Portugal

December

DECEMBER 11-13

Complex Networks 2018

The International Conference on Complex Networks and their Applications aimed at bringing together researchers from different scientific communities working on areas related to complex networks.

Co-organiser: Luís Rocha (IGC)

Sponsors: Cambridge University Press, Elsevier, future internet, PLOS, Springer, World Scientific. Cambridge, UK

Presentations by IGC Researchers 2018

At INTERNATIONAL Meetings and Seminars

ADRAIN, Colin

Regulation of inflammation and metabolism by trafficking control

in the secretory pathway Department of Biochemistry, University College, Cork, Ireland – April

Regulation of inflammation by trafficking control in the secretory pathway

National University of Ireland, Galway, Ireland – April

iRhom pseudoproteases & metabolic regulation EMBO Workshop on Pseudoenzymes, Sardinia, Italy – May

A role for UBXD8 in the regulation of adipose tissue homeostasis *in vivo* EMBO Workshop on the Endoplasmic reticulum function in health and disease

Lucca, Italy - October

AIRES, Rita

Oct4 Is a Key Regulator of Vertebrate Trunk Length Diversity

Joint meeting of the Portuguese, Spanish and French Societies of Developmental Biology, Porto, Portugal – November

ALENQUER, Marta

Influenza A virus ribonucleoproteins form liquid organelles at Endoplasmic reticulum exit sites
Influenza Update meeting,
University of Cambridge Cambridge, UK – December

AMORIM, Maria João

Mechanisms of influenza A virus assembly Meeting on Vesicular Biology, Coimbra, Portugal – February

Mechanisms of influenza A virus modulation of host membrane trafficking Cambridge Virology seminars, University of Cambridge, Cambridge, UK – April

Membrane regulators of complement activation modulate influenza A virus infection

6th International Influenza Meeting, Munster, Germany – September

Strategies of influenza A virus adaptation to hosts TIBE 2018, International Conference, CiBio, University of Porto, Porto, Portugal

- December

BAENA-GONZÁLEZ, Elena

Interplay between ABA and SnRK1 signaling for growth regulation EMBO Workshop TOR signaling in photosynthetic organisms, France – May

BALBONTIN, Roberto

The cause of the cost and the cost of the cause Cold Spring Harbor Laboratory Advanced Bacterial Genetics Course, NY, USA – June

BANK, Claudia

Positive and negative selection (and related problems) 2018 Workshop on Population and Speciation Genomics, Czech Republic – January

On adaptation, epistasis, and fitness landscapes Workshop "Living Matter", International Center for Theoretical Sciences, India – April

What can we learn from experimental fitness landscapes? SMBE 2018, Japan – July

What do we need to predict the evolution of drug

resistance? Evolution/ESEB 2018, France - August

Hybridization on rugged fitness landscapes

Institute of Science and Technology, Austria – September

Fitness landscapes and epistasis

DFG International SPP Meeting on Rapid evolutionary adaptation, Germany – October

BECKER, Jörg

Evolution of Sexual Reproduction in Plants - the EVOREPRO consortium ERA-CAPS workshop, Bon

ERA-CAPS workshop, Bonn, Germany – November

BELDADE, Patrícia

Environmental regulation of development: GxE and ExE interactions and phenotypic variation

Annual Meeting of "Laboratoire d'Excellence" TULIP, France – May

Developmental Plasticity: ExE and GxE effects in insect body size and pigmentation

Joint Meeting of the Portuguese, Spanish and French Societies for Developmental Biology, Portugal – November

BETTENCOURT DIAS, Mónica

Evolution of biomolecular networks: development

Evolution of Biomolecular Networks: Rules of the Game, Lorentz Center, Leiden, Netherlands – April

EMBO | EMBL Symposia, Microtubules: from Atoms to Complex Systems, Heidelberg, Germany – May

Cell Cycle Meeting Salk Institute, La Jolla, CA, USA – June

EMBO Workshop Cilia 2018, Copenhagen, Denmark – October

BLANCKAERT, Alexandre

In Search of the Goldilocks Zone for Hybrid Speciation ECMTB 2018 Lisbon, Portugal – July

The intricate dynamics of hybrid speciation

Evolution/ESEB 2018, France – August

BOM, Joana

Germ-Free Animal trends, Management, Equipment, Program/SOP set up, and Training opportunities in China

Tecniplast Short Course 2018, Shanghai, Beijing, Guangzhou, and Chengdu, China – May

Gnotobiology Core facility: set-up and Innovation

Core Technologies for Life Sciences 2018 Congress, Satellite Session 2 "Modelling the Microbiota-Host Superorganism: Animal Models and Core Facilities", Ghent, Belgium – July

Gnotobiotic models

Master Course in Laboratory Animal Science and Welfare, Module 2/ Topic 5.2, Universitat Autònoma de Barcelona, Barcelona, Spain – November

BORGES, Vanessa

Communicating Your Research to a Lay Audience, 11th NYRA Meeting, Lisbon, Portugal – May

CARAMALHO, Íris

Towards the identification of genetic susceptibility factors underlying early onset Type I diabetes

EFSD/JDRF/Lilly Research Grant Program: Advances in Beta Cell research, Germany – February

CARLOS, Ana Rita

Metabolic adaptation establishes disease tolerance to sepsis

14th International SPDM Symposium, Porto, Portugal

– March

CARNEIRO, Jorge

Time-lapse bioimage analysis solved as a cellular moprhodynamics model fitting problem

6th International Iberian Biophysics Congress and X Iberoamerican congress of Biophyscs, Symposium on Physics in Biology, Castellon, Spain – June

CARVALHO, Edison

The role of SS72 in Telomere biology

Embo Workshop: Telomere Biology in Health and Disease, Portugal – May

CASTRO, Diogo

The Stem Cell Niche Conference, Copenhagen Bioscience Conferences, Copenhagen, Denmark – May

Institute of Molecular Biotechnology (IMBA), Vienna, Austria – July

Joint Meeting of the Portuguese, Spanish and French Societies of Developmental Biology, Porto, Portugal – November

CHAOUIYA, Claudine

Logical modelling of cellular networks, introduction and methodological challenges

Mini-symposium of the 11th European Conference on Mathematical and Theoretical Biology, Lisbon, Portugal – July

Assessing attractor reachability in asynchronous logical models

Discrete Models and Formal Verification in Biology meeting, Murray Edwards College, Cambridge, UK – August

CHIKHI, Lounès

Open Day of the Museum of Natural History of Toulouse, Toulouse, France – September

COELHO, Inês

Ablation of TREM-2 reveals a liver macrophage population involved in transition to fibrosis resolution EASD NAFLD Study Group, Oxford, UK – April

DOMINGOS, Ana

Sympathetic Neuroimmunity of Obesity

4th Annual Symposium on Macrophages – A cell for all seasons: Macrophages in Health and Disease, Edinburg, UK – January

Sympathetic

Neuroimmunity of Obesity

Cell Press-Weizmann Institute Symposium: NextGen Immunology, Weisman Institute, Tel Aviv, Israel – February

Sympathetic

Neuroimmunity of Obesity

Deuel Conference Neural Control of Nutrient Metabolism, La Jola, CA, USA – March

Sympathetic

Neuroimmunity of Obesity

Keystone Meeting "Organ Crosstalk in Obesity and NAFLD", Colorado, USA – May

Sympathetic

Neuroimmunity of Obesity

Singapore Symposium of Immunology, Singapore – May

Sympathetic

Neuroimmunity of Obesity

AtheroFlux, Greece - June

Sympathetic

Neuroimmunity of Obesity

6th Helmholtz Diabetes Meeting, Munich – September

Sympathetic

Neuroimmunity of Obesity

Conference of Foundation des Treilles Brain-Periphery Communications in Metabolic Control, Provence, France – October

Sympathetic

Neuroimmunity of Obesity

Immunogenomics Hudsonalpha AAAS Science 2018, Alabama, USA – October

Sympathetic

Neuroimmunity of Obesity

Necker Hospital des Enfants Malades, Paris

Sympathetic

Neuroimmunity of Obesity

Université Libre de Bruxelles, Bruxelles, Belgium

Sympathetic

Neuroimmunity of Obesity Karolinska Institutet, Stockholm

DUARTE, Elves H.

Identification of the genetic bases of new over-prolifera-

tive Wolbachia variants Wolbachia Conference 2018, Salem Massachusetts, USA

DUQUE, Paula

A role for alternative splicing in plant tolerance to environmental stress

The Coins – International Conference of Life Sciences, Lithuania – February

Post-transcriptional control of ABA-mediated stress responses

 $31^{\rm st}$ Conference Molecular Biology of Plants, Germany

- February

Plant responses to Stress: Post-transcriptional control of the ABA pathway

Durham University, UK

- October

Feeding the world in the 21st century

Guadalajara International Book Fair, Guadalajara, Mexico – November

EL-MAI, Mounir

Apoptosis or senescence: cell fate determinants during aging and regeneration Aquatic research models to study regeneration and aging workshop, France – November

EUGÉNIO, Ana Teresa

Aransposable element awakening upon environmental perturbation

A4th European Meeting of PhD Students in Evolutionary Biology (EMPSEB 24), Spain – September

FERREIRA, Miguel G.

Telomere shortening increases cancer incidence in a non-cell autonomous manner

5th European Zebrafish PI Meeting, Italy – March

Development of a functional assay for personalised chemotherapy using Zebrafish

Cancer Modeling Meeting, Spain – June

Telomere shortening increases cancer incidence in a non-cell autonomous manner

Zebrafish Disease Models 2018, Netherlands – July

Systemic telomere shortening is a cause for increased cancer incidence in Zebrafish

 $3^{\rm rd}$ International Conference on Aging and Disease, France – October

FESEL, Constantin

Lymphopenia-associated unstable t-cell regulation mirrors disease activity-related clonal t-cell expansions in Systemic Lupus Erythematosus (SLE)

11th International Congress on Autoimmunity, Lisbon, Portugal – May

T-cell regulation in Systemic Lupus Erythematosus

11th International Congress on Autoimmunity, Lisbon, Portugal – May

FRAGATA, Inês

Hidden impact of synonymous mutations on adaptation to new environments

Evolution/ESEB 2018, France – August

Predictability of long-term, but not short-term phenotypic evolution of Drosophila, ECMTB 2018 Lisbon, Portugal – July

GJINI, Erida

Mathematical perspectives on host immunity and antibiotic treatment

Minisymposium "How to design evolution-proof public health interventions", European Conference on Mathematical and Theoretical Biology 2018 (ECMTB 2018), Lisbon, Portugal – July

New model formalisms for inferring phenotypic heterogeneity in bacteria

Viral Infections from an Evolutionary Perspective Workshop, Frankfurt Institute for Advanced Studies, Frankfurt, Germany – December

GONCALVES-SÁ, Joana

Who's Afraid of Influenza?

Using the Flu to Study Anxiety

NetSci 2018, Contagion and Networks Satellite, Paris, France – June

GORDO, Isabel

Real time evolution of commensal bacteria in the mammalian gut Solvay Workshop on 'Dynamics of biological systems: Modelling genetic, signalling and microbial networks', Brussels, Belgium – May

The role of epistasis on the fate of single and multiple resistances across environments

Antibiotic Resistance Symposium, Stockholm, Sweden – June

Evolution in real time of gut commensal bacteria Seminar at Bern University,

Bern, Switzerland - June

Evolution of commensal bacteria in the gut, EMBO Members' Meeting 2018, Hei-

delberg, Germany - October

Epistasis in antibiotic resistance

NDPIA/IBA course on Antibiotics and Antimicrobial Resistance at Hjortviken Konferens, Gothenburg, Sweden

– November

The role of epistasis on the fate of single and multiple resistances across environments

Lecture series "Antibiotic Drug Targets and Resistance", Biozentrum Basel, Basel, Switzerland – December

HOWARD, Jonathan

Host-parasite co-evolution between *Toxoplasma gondii* and the house mouse Universidad Autónoma de

Universidad Autónoma de Chile, Chile – January

Adaptation to continental travel: *Toxoplasma gondii* and the mouse

Molecular Biology and Genetics Student Congress'18, Istanbul Technical University, Istanbul, Turkey – October

JANA, Swadhin

Mechanisms of cilia maintenance and their consequences on organismal homeostasis International Congress of Cell Biology, Hyderabad, India – January

JANSEN, Lars

Chromatin-based epigenetic inheritance

UiO Centre for Molecular Medicine Norway, Oslo, Norway – January

Cell cycle control of Centromere assembly

Ludwig Institute for Cancer Research, La Jolla, USA

– March

Chromatin-based epigenetic inheritance

Institut Curie, Paris, France – May

Chromatin-based epigenetic inheritance: Lessons from the centromere

 $\label{eq:continuous} Institute of Molecular Genetics of the ASCR, Prague, Czech \\ Republic - June$

CENP-A assembly and stable transmission across the cell cycle

Gordon conference on Centromere Biology, Vermont, USA-July

Centromeric chromatin assembly and transmission across the cell cycle

Gordon conference on Chromatin Structure & Function, Maine, USA – July Chromatin-based
Epigenetic Inheritance.
Lessons from
the Centromere
Sir William Dunn School of
Pathology, Oxford, UK
– November

LAFUENTE. Elvira

Genetic basis of inter-genotype variation for thermal plasticity in *D. melanogaster* Joint Congress on Evolutionary Biology (ESEB, SSE, ASN, SSB): Evolution 2018, France – August

MALLO, Moisés

The different lives of axial progenitors during vertebrate body formation
Developmental Biology Minisymposium, Tallinn, Estonia
– September

The busy life of axial progenitors, the builders of the vertebrate body XIII congress of the Mexican Society of Developmental Biology, Puebla, Mexico – October

MARTINS, G.G.

GBI/Elixir Hackathon, Cambridge, UK – April

EMBO Practical course on 3D Developmental Imaging, IGC, Oeiras, Portugal – July

COST Leadership Academy, Brussels, Belgium – September

Woskhshop "OPenT" @ MiFo-Bio, Seignosses, France - October

Taggathon in NEUBIAS TS08/09 schools, Edinburgh, UK – October

Woskhshop "OPenT" @SPAOM, Granada, Spain – October EuroBioimaging Industry Board meeting, EMBL – November

MARTINS, Nuno Pimpão

EMBO Practical course on 3D Developmental Imaging, IGC, Oeiras, Portugal – July

MENA, Ana

Musical tales: one composer in residence and three movements of science PCST 2018 – Public Communication of Science and Technology Conference, Dunedin, New Zealand – April

MINHÓS, Tânia

Demographic history of West African primates inferred from genomic data 27th Congress of the International Primatological Society, Nairobi, Kenya – August

MOITA, Luís Ferreira

Homeostasis perturbations in sickness and in health 11th Seeon Conference, Munich, Germany – July

Homeostasis perturbations in sickness and in health Helmholtz Universität, Munich, Germany – July

NAVARRO-COSTA, Paulo

The unpacking of the sperm genome after fertilization requires the dMLL3/4 chromatin regulator 20^{th} European Testis Work-

The Trithorax group protein dMLL3/4 instructs the assembly of the zygotic genome at fertilization

shop, Óbidos, Portugal – May

Joint meeting of the Portuguese, Spanish and French Societies for Developmental Biology, Porto, Portugal – November

OLIVEIRA, Rui

An eco-evo-devo approach to the study of social behavior: lessons from (zebra)fish International Conference in Behavioural Ecology, University of Minnesota, USA – August

PAIS, Inês

Drosophila melanogaster has stable, beneficial and host-specific gut microbiota Institut de Biologie du Développement de Marseille, Marseille, France – June

Drosophila melanogaster
has stable, beneficial and
host-specific gut microbiota
IBMC – Institut de Biologie
Moléculaire et Cellulaire,
Strasbourg, France
– December

PANDYA, Yash

The trophoblast endothelin response as a mechanism for fetal protection in placental malaria

BioMalPar XIV: Biology and Pathology of the Malaria Parasite, Germany – May

PARKHOUSE, Michael

Pathogen manipulation of host cell biology and immune response

XII Congress of the Latin American Association of Immunology, Cancun, Mexico – May

PARREIRA, Bárbara

The genetic consequences of social structure International Meeting "Evolutionary models in Structured Populations", Plön, Germany – September

PAULO, Tânia

An experimental evolution approach to the influence

of immune history in adaptation against bacterial infections

EMPSEB, Granada, Spain
– September

PEREIRA, Hugo

EMBO Practical course on 3D Developmental Imaging, IGC, Oeiras, Portugal – July

REBELO, Manuel

Gnotobiology Facility implementation, achievements, and challenges
Modeling the Mammalian Microbiota Host Superorganism,
Current Tools and Challenges
Conference, Institut Pasteur,
Paris, France – October

ROCHA, Luís

Towards understanding the multi-level complexity of human health: from drug-interaction to human reproduction cycles

2nd Week of Complexity Sciences, Centro de Ciencias de la Complejidad C3, Universidad Nacional Autonoma de México, Mexico City, Mexico – January, February

Towards understanding the multi-level complexity of human health: from drug-interaction to human reproduction cycles Intelligent & Interactive Systems Talk Series, Indiana University, Indiana, USA – February

Towards understanding biosocial complexity in human health: from control of biochemical regulation of disease to social factors in drug-interaction and human reproduction

Network Medicine (NetMed18): Personalized Medicine in the Era of Big Data. NetSci 2018 Satellite symposium, Paris, France – June

Redundancy in Social Contact Networks for Epidemic Spread Models and in the Control of Biochemical Regulation Indiana University Complex Networks & Systems NSF-NRT Colloquium Series, Indiana, USA – November

Complex Systems from Cybernetics to Network Science: Modeling Multilevel Human Complexity

Universidad Nacional del Sur, Bahia Blanca, Argentina – November

RODRIGUES, Yara K.

Combined effects of day and night temperatures on thermally plastic traits Annual Meeting of the European Society for Evolution and Development, Ireland – June

SELVAGGIO, Gianluca

Logical modelling and analysis of cell adhesion properties along Epithelial to Mesenchymal Transition

W6 – Logical modeling of cellular networks, pre-meeting of the 17th edition of the European Conference on Computational Biology (ECCB 2018), Athens, Greece – September

SOARES, Miguel P.

Metabolic adaptation in disease tolerance to infection

Instituto de Parasitología y Biomedicina "López-Neyra" (CSIC), Spain – January

Metabolic adaptation in disease tolerance to infection

Institute of Immunology and

Infection Research, School of Biological Sciences, University of Edinburgh, Edinburgh, UK – February

A cross-talk between iron and glucose metabolism that establishes disease tolerance to malaria

Biozentrum, University of Basel, Basel, Switzerland – March

A cross-talk between iron and glucose metabolism that establishes disease tolerance to malaria

MRC Human Immunology Unit, University of Oxford, Weatherall Institute of Molecular Medicine, Oxford, UK – March

Iron and glucose metabolism cross talk to establish disease tolerance to infection

Gene Expression and Signaling in the Immune System Cold Spring Harbor Laboratory (CSHL) Meeting, Cold Spring Harbor, USA – April

Metabolic adaptation in disease tolerance to infection

University of Chicago, Chicago, USA – April

Metabolic adaptation in disease tolerance to infection

Sapienza Università di Roma, Roma, Italy – May

A cross talk between heme and glucose metabolism in disease tolerance to bloodstream infection

19th Biennial Meeting Society for Free Radical Research International (SFRRI), Portugal – June

A cross talk between heme and glucose metabolism in disease tolerance to blood-

stream infection TOLL 2018, Portugal – June

Labile heme & metabolic adaptation to infection

Gordon Research Conference Chemistry and Biology of Tetrapyrroles, USA – July

Macrophages, iron metabolism & homeostasis

32nd Annual Conference EMDS2018, Italy – September

Metabolic adaptation: a defense strategy against infection

Center for Research in Molecular Medicine and Chronic Diseases (CIMUS), Spain – October

Metabolic adaptation: a defense strategy against infection

Max Planck Institute of Biochemistry, Germany

– October

Heme regulation of glucose metabolism in bloodstream infection

10th International Conference on Heme Oxygenase (HMOX 2018), South Korea

– November

SUCENA, Élio

La evolución y el Darwinismo

Guadalajara International Book Fair, Guadalajara, Mexico – November

Chasing the elusive origins of novel enhancers: one step to novelty

Joint meeting of the Portuguese, Spanish and French Societies of Developmental Biology, Porto, Portugal

- November

TEIXEIRA, Luís

Bacterial symbionts of *Drosophila melanogaster*

Origins and Function of Metaorganisms, Collaborative Research Centre, Kiel, Germany – May

Growth regulation of the antiviral symbiont *Wolbachia*

Toll 2018 Editing Innate Immunity, Porto, Portugal

Drosophila immunity and symbionts

Drosophila Genetics and Genomics course 2018, Wellcome Genome Campus, Cambridge, UK – July

Growth regulation of the antiviral symbiont Wolbachia

XI European Congress of Entomology, Naples, Italy – July

June D. melanogaster interaction with stable gut-colonizing bacteria in wild populations

32nd French Drosophila Meeting, Presqu-'île de Giens, France – October

TELLEY, Ivo

The spatial organiser in the *Drosophila* syncytial embryo

DGZ Young Investigator Forum, Berlin, Germany
– March

The spatial organiser in the *Drosophila* syncytial embryo

FlyJEDI Meeting 2018, Girona, Spain – October

Origin and mechanical principles of the spatial organisation in the *Drosophila* syncytial embryo

Department of Cell Biology – University of Bern, Bern, Switzerland – November

Probing intracellular self-organization under ge-

ometric constraints using micro-compartments and micromanipulation

MBI-National University of Singapore, Singapore - December

TRANFIELD, Erin

Using Correlated Light and Electron Microscopy to find the Needle in the Haystack TiM 2018 – Annual Conference of the German Research Foundation, Dusseldorf, Germany – February

XAVIER, Karina

Bacterial Interspecies Quorum Sensing in the Mammalian Gut Microbiota

Gordon Research Conference on Sensory Transduction in Microorganisms, sensing and Signalling: From Single Molecules to Host-Microbe Interactions, Ventura, CA, USA – January

Inter-species Quorum sensing in the mammalian gut microbiota

Bacterial Interspecies Quorum Sensing in the Mammalian Gut Microbiota

Bioengineering Department, Shriram Center, Stanford University, Stanford, CA, USA – January

Talking from the gut: cellcell communication in the gut microbiome

Workshop: Physical Principles Governing the Organization of Microbial Communities, Aspen, CO, USA – June

Bacterial Interspecies Quorum Sensing in the Mammalian Gut Microbiota

Microbial Sciences Institute Seminar, Yale University, Yale, USA – July VAAM-FG Summer School in Mechanisms of Gene Regulation, Tutzing, Germany – September

At National Meetings and Seminars

ADRAIN, Colin

iRhom pseudoproteases & metabolic regulation
10° Simpósio de Metabolismo, Faculdade de Medicina,
Universidade do Porto, Porto
– October

AMORIM, Maria João

Mechanisms of influenza A virus modulation of host membrane trafficking External seminars, Universidade de Aveiro, Aveiro – May

BAENA-GONZÁLEZ, Elena

To grow or not to grow: The role of sugar signals in plant growth and development

Ciência 2018, Lisboa, Portugal – July

BALBONTIN, Roberto

DNA breaks are key contributors to the cost of antibiotic resistance mutations in *Escherichia coli* iBiMED, Universidade de Aveiro, Aveiro – December

BANK, Claudia

Hybridization on rugged fitness landscapes

Centre for Ecology, Evolution, and Environmental Changes (CE3C), Universidade de Lisboa, Lisboa – November

BARRETO, Hugo

The interplay between aging and the evolution of gut microbiota XIV ENBE, Lisboa – October

BECKER, Jörg

Land plant evolution from the perspective of a tiny moss

X Jornadas de Genética e Biotecnologia, Vila Real, Portugal – March

NGS technologies @ IGC

Advanced course on Genomics, Metagenomics and Bioinformatics, University of Minho, Braga – July

BLANCKAERT, Alexandre

Muller's Ratchet and the Long-Term Fate of Chromosomal Inversions, ENBE XIV, Lisboa – October

BORGES, Ana Cristina

Navigating in a facility with multiple aquatic species

IV Congresso da Sociedade Portuguesa de Ciências de Animais de Laboratório (SPCAL), Escola de Medicina/Instituto de Ciências da Vida e da Saúde, Universidade do Minho, Braga, Portugal – June

Bridging the gap between zebrafish embryo and adult studies

1st CONGENTO Annual Meeting, Instituto Gulbenkian de Ciência, Oeiras – October

BORGES, Filipa

Serão todos primos? A genética na conservação dos primatas da África Ocidental Encontro Aberto de Primatologia, USALMA, Almada – July

BRAVO, Inês

Visual Communication / How to create a graphical abstract?,

UCIBIO/LAQV, FCT-UNL, Costa da Caparica – April

CABRAL, Vítor

Role of the microbiota against multidrug-resistant enterobacteriaceae ONEIDA Project meeting 2018, ITQB-NOVA, Oeiras – June

CARDOSO, Luís

Fitness costs of antibiotic resistance in the mammalian gut

XIV ENBE, Lisboa - October

CARNEIRO, Jorge

The sensorimotor system of a sperm cell

CFTC-IBEB Initiative: Soft Matter in Biomedicin, Lisboa – October

Quantitative insights into the mechanism of chemotaxis and mating choice by spermatozoa

Seminar at CEDOC, Lisboa – October

O futuro da imunologia I&I – Imunidade e Infecção. ICBAS. Porto – December

CARVALHO, Inês

Colaboração para a Conservação – Desafios no estudo de cetáceos em São Tomé e Príncipe

1º Congresso de Biologia Marinha dos Países de Língua Portuguesa, Universidade do Algarve, Faro – January

Conservation of Sado estuary bottlenose dolphins population – What can we learn from that?

Encontros Scientia, Faculdade de Ciências da Universidade de Lisboa, Lisboa – March

CASTRO, Diogo

Chronic Diseases Research

Center (CEDOC), Lisboa – December

CHIKHI, Lounès

The IICR (inverse instantaneous coalescence rate) as a summary of genomic diversity: insights into demographic inference and model choice

Encontro Nacional de Biologia Evolutiva, Lisboa – October

COELHO, Inês

Ablation of TREM-2 reveals a resident macrophage population impairing tissue repair responses to liver damage

Portuguese Immunology Society, Lisboa – June

CONFRARIA, Ana

Regulation of shoot branching by the energy signalling pathway

Green-IT research Unit annual meeting, Oeiras - November

COSTA, Mónica

SnRK1 regulation of laral root growth in response to stress signalste

Plant Interaction Meeting (monthly meeting of plant research groups in the Lisbon area). Oeiras – December

DEMENGEOT, Jocelyne

Targeting natural immune regulation in oncology 25th Porto Cancer meeting, Porto – April

DUARTE, Nádia

Dipeptidyl Peptidase-4 (CD26/DPP-4) is a Prorecovery Mediator During Acute Hepatotoxic Damage and Mirrors Severe Shifts in Kupffer Cells Portuguese Immunology Society, Lisboa – June

DUQUE, Paula

Posttranscriptional control of plant stress tolerance Centro de Estudos de Doenças Crónicas (CEDOC), Lisboa

March Posttranscriptional regulation of plant tolerance to stress

BioSAM – Biological Sciences Annual Meeting, Faculdade de Ciências da Universidade de Lisboa (FCUL), Lisboa – April

DURÃO, Paulo

Seleção Natural de Resistência a Antibióticos, Pint of Science, Lisboa – May

EDUARDO, Gustavo

Establishing experimental conditions to study Wolbachia cytoplasmic incompatibility in Drosophila melanogaster

Drostuga – Annual Portuguese Drosophila Meeting, Tomar – September

FAÍSCA, Pedro

Quantifying myocardial fibrosis on murine model samples stained with Masson's Trichrome using ImageJ, Validating the use of macros as valid and less variable method

Escola Universitária Vasco da Gama, Coimbra – June

Comparison between Visual Assessment and Automated Digital Image Analysis (ImmunoRatio) of Ki67 Index in Mastocytoma, Feline Mammary Carcinoma and Canine Mammary Tumors June

FONSECA, Irina

Consequences of centriole aberrations on stemness and tumour microenvironment 3rd PhD meeting of Program for Science and Development (PGCD), Oeiras – November

FRAZÃO, Nelson

Sex overrides mutation in Escherichia coli colonizing the gut

Microbial Eco-Evolutionary Dynamics Symposium, Oeiras – October

GJINI, Erida

Understanding microbial dynamics and interventions with mathematical models Bionformatics Open Days Workshop, University of Braga, Braga – March

GONÇALVES-SÁ, Joana

Data Mining for Decision-Making Research Seminar – CEDOC, FCM–UNL, Lisboa – January

Poderá o "Big Data" tornar a cidade mais humana? Portugal Smart Cities Summit, Lisboa – April

Emotions in Political Arguments: A Possible Computational Analysis of 40 Years of Political Debates

IX Associação Portuguesa de Ciência Política, APCP Congress, Braga – April

Data Mining for Decision-Making

Research Seminar, Physics Colloquia, Physics Department, IST-UL, Lisboa – May

Data Mining for
Decision-Making
Data Science for Social Good

Summer School, NovaSBE, Lisboa – June

Fórum dos Cidadãos - What conditions should we offer to migrants?

Encontros com os cidadãos, Governo de Portugal, Centro de Apoio aos Refugiados, Bobadela — September

From Online Breadcrumbs to Offline Fears: Using Data Science to Understand Behaviour INSIGHTS 2018, Data Science Portuguese Association – DSPA, Lisboa – September

Identifying and Predicting Emergency Admissions

Data Science and Artificial Intelligence Programme
– DSAIP 2018, Funded projects public presentation, Lisboa
– October

Data Mining for Decision-Making – From disease forecasting to political arguments

IX ITQB NOVA Student Retreat, Research Seminar, Oeiras – November

Digital Competencies in Researchs

INCoDe 2030 – 2ª. Conferência Fórum Permanente para as Competências Digitais, Lisboa – December

GORDO, Isabel

Epistasis and the Fate Resistant Bacteria Across Environments IGC, Oeiras – June

Eco-evolutionary dynamics in the microbiota of the

mammalian intestine

Portuguese Society of Genetics
- Annual Meeting 2018, i3S,
Porto - June

Causes and Consequences of Antibiotic Resistance

7º Encontro "MEFT – A Desafiar os Limites em Ciência e Tecnologia, IST, Lisboa – June

Epistasis and the Fate Resistant Bacteria Across Environments

cE3C meeting, FCUL, Lisboa – July

Evolution in the gut microbiota

Microbial Eco-Evolutionary Dynamics Symposium, IGC, Oeiras – October

LEOCÁDIO, Ana Sofia

Implementation of a mouse Gnotobiology Facility to host microbiota-related studies

IV Congresso da Sociedade Portuguesa de Ciências de Animais de Laboratório (SPCAL), Braga, Portugal – June

Implementation of a mouse Gnotobiology Facility to host microbiota-related studies

1st CONGENTO Annual Meeting, Instituto Gulbenkian de Ciência, Oeiras, Portugal – October

LINCE-FARIA, Mariana

Identification of new Microtubule Associated Proteins involved in centriole biogenesis

Ciência 2018, Lisboa – July

LOPES, Carla

Deregulation of cellular structures associated with cancer

Ciência 2018, Lisboa - July

LOPES, Filipa

Function of SnRK1 kinases in the shoot apical meristem

Plant Interaction Meeting (monthly meeting of plant

research groups in the Lisbon area), Oeiras – January

MAHÚ, Inês

The Neuronal Control of Body Fat

 $\begin{array}{l} {\rm IGC~Summer~School~Pro}\\ {\rm gramme~2018,~Oeiras-July} \end{array}$

OBESIDADE: A Gordura Corporal é controlada por Neurónios

I Conferência Cientistas em tournée – Prémios Maratona da Saúde, Lisboa – December

MALLO, Moises

The genetic control of axial progenitor activity during formation of the vertebrate body CEDOC, Lisboa – October

MARTINS, Gabriel G.

Mesoscopy

- Frontier between bio and medical imaging CNC, Universidade de Coim-

bra, Coimbra – January

microWorkshop on Image Analysis, IGC, Oeiras – March

Bioimagiologia, Faculdade Ciências da Universidade de Lisboa, Lisboa – March

Bioimaging techniques + Image Analysis, IGC, Oeiras - July

"Image Analysis" workshop, Champalimaud Center for the Unknown, Lisboa – November

MARTINS, Nuno Pimpão

microWorkshop on Image Analysis, IGC, Oeiras – March

Super-resolution microscopy techniques, Bioimagiologia MSc Course, FCUL, Lisboa – March

Image Analysis

10th Course on Optical Microscopy Imaging for Biosciences, i3S, Porto – April

Image Analysis

XXIII Meeting of the Portuguese Society of Animal Pathology, Coimbra – June

Bioimaging techniques + Image Analysis, IGC, Oeiras – July

"Image Analysis" workshop, Champalimaud Center for the Unknown, Lisboa – November

MATOS, Gonçalo

Molecular mechanisms regulating bacterial colonization of the gut

2018 Annual Portuguese Drosophila meeting, Tomar – September

MENA, Ana

Comunicar Ciência: porquê, para quê, como e com quem?

Instituto Superior de Agronomia, Lisboa – March

Communicating animal science

CONGENTO meeting, Instituto Gulbenkian de Ciência, Oeiras – October

MOITA, Luís Ferreira

The importance of being tolerant

XXXVIII Congresso Nacional de Cirurgia, Lisboa – March

We need to talk!

Meeting at the Portuguese College of Physicians on the Future of Medicine – October

Homeostasis perturbations in sickness and in health

XXI annual meeting of the Portuguese Pediatrics Society for Intensive Care Specialists – November

MONTEIRO, Marta

Spillover and Compensation

2nd FLxFlow Course: Principles and Applications of Flow Cytometry, IGC, Oeiras
November

Advanced experimental planning and troubleshooting

2nd FLxFlow Course: Principles and Applications of Flow Cytometry, IGC, Oeiras

November

NUNES, Catarina

Co-option in *Drosophila:* Metamorphosis and the Immune System

DROSTUGA – Congresso Nacional de Drosophila, Tomar, Portugal – September

Co-option in *Drosophila*: Metamorphosis and the Immune System

Encontro Nacional de Biologia Evolutiva, Lisboa, Portugal – October

OIKONOMIDI, Ioanna

A novel iRhom interactor, controls TNF secretion by policing the stability of iRhom/TACE sheddase complex

2nd Small Meeting on Endocytic Trafficking and Signaling, International Iberian Nanotechnology Laboratory (INL), Braga – July

OLIVEIRA, Ana Rita

Enhancing bacterial signalling to mediate recovery of the gut microbiota functions

Annual Meeting of Gulbenkian Students (AmeeGuS), Évora – March

OLIVEIRA, Rui

Simple minds living in complex social worlds 12th BIAL Symposium "Enhancing the mind", Porto

- April

PAIS. Teresa F.

Cerebral malaria: a vascular inflammatory disease iBimed, University of Aveiro – Aveiro

PARREIRA, Bárbara

As sifakas minimizam a endogamia?

Encontro Aberto de Primatologia, USALMA, Almada – July

Does social structure minimize genetic and genotypic diversity

in sifakas?

Encontro Nacional de Biologia Evolutiva, Lisboa – October

PENHA-GONÇALVES, Carlos

Maternal-fetal conflict during infection: lessons from placental malaria CEDOC, Universidade Nova de

CEDOC, Universidade Nova d Lisboa, Lisboa – November

PEREIRA, Hugo

microWorkshop on Image Analysis, IGC, Oeiras – March

Bioimaging techniques + Image Analysis, IGC, Oeiras - July

OpenSpin and OPenT for mesoscopic imaging of biological samples INCOMAM18 SPMicros, Coimbra – October

RAMIRO, Ricardo

Insisting on the error: On the emergence and maintenance of high mutation rates within the gut microbiota Portuguese Society of Genetics – Annual Meeting 2018, Porto

– June

RAMOS, Cíntia

Condensin II in *Drosophila* male meiosis: A single complex with dual roles
Drostuga, Tomar – September

REBELO, Manuel

1st CONGENTO
Annual Meeting:
Rodent Working Group
1st CONGENTO Annual Meeting, Instituto Gulbenkian de
Ciência, Oeiras, Portugal
October

ROCHA, Luís

Towards understanding the multi-level complexity of human health: from control of biochemical regulation of disease to social factors in drug-interaction
Fundação Champalimaud,
Lisboa – April

Towards understanding biosocial complexity in human health with network & data science

Nova School of Business and Economics, Lisboa – June

Redundancy in the Structure and Dynamics of Complex Networks

Instituto de Sistemas e Robótica, Instituto Superior Técnico, Lisboa – July

Complex Networks and Systems: using data-driven and interdisciplinary nonlinear thinking for decision making

Nova School of Business and Economics, Carcavelos

October

RODRIGUES, Yara

Thermal plasticity in a seasonal polyphenism model: effects of non--constant temperatures Annual Meeting of the PGCD – November

SGARLATA, Gabriele Maria

Investigating the genetic consequences of habitat loss and fragmentation CEFS (Comportement et Ecologie de la Faune Sauvage), France – March

Revising conservation status of lemur species from Northern Madagascar IUCN Leumur Red Listing, Madagascar – May

SILVA, Marta

Gut bacteria increase both resistance and tolerance to systemic viral infection in *Drosophila* melanogaster 2018 Annual Portuguese Drosophila meeting, Tomar – September

SOARES, Nuno

The chewing machine – evolution of mouth morphology in *Drosophila* larvae
DrosTuga, Tomar – September

The chewing machine – evolution of mouth morphology in *Drosophila* larvae
Encontro Nacional de Biologia
Evolutiva (ENBE), Lisboa

SOUSA, Ana Laura

October

Introduction to Electron Microscopy

Master's Program in Biomedical Research at NMS (NOVA Biomedical Research — NBR) — October

SUCENA, Élio

Chasing the elusive origins of novel enhancers Portugaliae Genetica, Porto, Portugal – March

MicroRNA-31b is a fat body development regulator with impact on adult immunity in *D. melanogaster* DROSTUGA – Congresso Nacional de Drosophila, Tomar, Portugal – September

Evolution of transcriptional regulation: one step to novelty

Encontro Nacional de Biologia Evolutiva, Lisboa, Portugal – October

TEIXEIRA, Luís

Microbiota in neonates Postgraduate course in Neonatal Medicine, Instituto de Ciências da Saúde, Universidade Católica, Lisboa – February

TELLEY, Ivo

A single egg cell-free system amenable to mechanical manipulation

Biophysical Constraints and Evolutionary Cell Biology Workshop, IGC, Oeiras – July

Drosophila Fertilization and syncytial embryogenesis in absence and presence of Wolbachia infection CEDOC – Universidade Nova de Lisboa, Lisboa – October

TORCATO, Inês

Quorum sensing signal recognition by a novel AI-2 receptor from Clostridia
Annual Meeting of Gulbenkian
Students (AmeeGuS), Évora
– March

The discovery of novel autoinducer-2 receptors 9th ITQB-NOVA PhD students meeting, ITQB-NOVA, Oeiras

– November

TRANFIELD, Erin

The Roadmap Towards a National CryoEM Facility Cryo-EM Workshop, International Iberian Nanotechnology Laboratory, Braga, Portugal – April

VIDAL, Sheila

Apoio à captação de financiamento competitivo Curso de Gestão de Ciência para PALOP, IGC, Oeiras – February

VIEIRA, Filipe

Quorum sensing regulation in Erwinia carotovora affects the development of *Drosophila* melanogaster Annual Meeting of Gulbenkian Students (AmeeGuS), Évora — March

XAVIER, Karina

Bacterial Interspecies Quorum Sensing in the Mammalian Gut Microbiota CIIMAR / Universidade do Porto, Porto – April



Students and Teachers participated in IGC initiatives

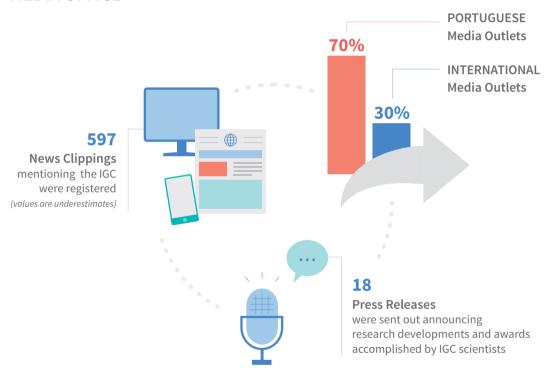
Researchers & Technicians engaged in Outreach Activities



PUBLIC ENGAGEMENT IN SCIENCE

Public Engagement in Science 2018

MEDIA OFFICE



NEW MEDIA



Multimedia Resources

Production videos

An institutional video was produced aiming at informing candidates on the open call to recruit principal investigators and independent fellows. Six episodes of the video series "PhD in a minute" were produced, introducing the thesis work developed by IGC PhD candidates. Furthermore, a video to celebrate IGC scientists was released on the Scientists National Day, as well as 3 short videos related to the commemoration International Day of Immunology. A new publicity spot to announce the NOS Alive-IGC fellowships at NOS Alive Music Festivals was launched.



Frame of the video celebrating the Scientists National Day.

Science Education Projects

Schools' outreach

In 2018, 61 students from Universities (ISPA – Instituto Universitário de Ciências Sociais e da Vida, Universidade Católica Portuguesa and Faculdade de Ciências da Universidade de Lisboa) visited the IGC. In addition, we received 31 requests, either to visit the IGC, to go to the schools, or to provide material or assistance in the development of science projects.



A student follows an IGC scientist and learns more about laboratory work.

Job Shadowing — Scientist for a Day

Aiming at support informed career choices, this programme provides an opportunity for senior high school students to spend an entire day with a scientist at the IGC, and learn more about the job. Seventy students, from 41 schools, enrolled in this programme in 2018, during Easter, Summer and Christmas school break.

Workshop for teachers: "Inspirar Ciência 2018 – Plantas"

This 4-day workshop is targeted at high school biology teachers with the goal of updating them on the most recent research and experimental protocols. The 2018 edition focused on Biology of Plants and combined informal lectures, laboratory sessions and group work to produce a final presentation, all assisted by IGC researchers from the three plant groups. Twenty teachers (out of 26 applications) were admitted. This workshop was credited for teachers' continuous professional development by the national Conselho Científico-Pedagógico da Formação Contínua.



Teachers working in the lab, during the workshop "Inspirar Ciência 2018 - Plantas".

Engagement of Socially Vulnerable Communities in Science

Project "Embodying memories"

The Science Communication team ran an exploratory project with a group of 14 senior migrant women living in Outorela, Portugal, to promote their engagement in science. With innovative approaches covering science, art and communication, the team explored ways to bring science closer to a community with limited education and resources. The project "Embodying memories" addressed neuroscience topics in 8 sessions of 2h and included a visit to the Gulbenkian Museum and a

visit to the IGC. Andreia Dias, from the Gulbenkian Museum, and Cláudia Gonçalves, PhD student at the Integrative Behavioural Biology research group, collaborated in the successful implementation of this project.



A group of senior migrant women gathered in a session of the project "Embodying memories".

Public Events

COGITO Festival

21 APRIL

Upon invitation by the Oeiras City Council, 4 IGC researchers participated in "Festival COGITO – Ideias que transformam", an event structured around short lectures delivered by inspiring and mobilizing speakers. The researchers promoted 2 hands-on activities in a science-dedicated lounge.

International Day of Immunology

2 MAY

The IGC joined the celebrations of the International Day of Immunology with lectures, hands-on activities and visits to the laboratories, to explore some of the scientific discoveries that can improve our health. This year, before the event, the public chose the 3 topics of the talks, out of seven different Immunology topics up for voting: auto-immunity, vaccination and microbiota. Five IGC research groups and one facility interacted with 30 citizens.



Students learning about the work of immunologists at IGC, through hands-on activities.

IGC at NOS Alive'18

12-14 JULY

The IGC was present at NOS Alive festival for the 11th time in a row. In this edition, the scientists brought to the festival a Speed-Dating activity and the "The Dark Side of Science", an installation where visitors had the opportunity to explore the fluorescent world of science – microscopes with GFP samples, fluorescent organisms, images and videos. Fifty IGC volunteers made the activities possible for about 1500 young people who visited the IGC corner.



"The Dark Side of Science" fluorescent room was the highlight of IGC's presence at NOS Alive music festival.

International Physics Olympiad

23 JULY

In 2018, the 49th edition of the International Physics Olympiad (IPhO 2018) for high school students was held in Lisbon, with social events taking place in other municipalities.



Students from different countries participating in hands-on activities during the International Physics Olympiad.

Upon invitation by the Oeiras City Council, the IGC joined the IPhO2018, and 8 IGC researchers promoted 3 hands-on activities for 500 students, from 90 different countries, at the garden of the Palace of the Marquis of Pombal.

IGC at the European Researchers Night

28 SEPTEMBER

The IGC participated in the European Researchers Night held at the Natural History Museum, in Lisbon, with the activity "Alert: Infection!". About 200 visitors engaged in this interactive game that took them through a journey in the city, from home to work, to illustrate the ease of contamination through surfaces and how a simple hand wash can reduce this contamination.



A look over IGC's science during the European Researchers' Night.

IGC Open Day — Where will curiosity take you?

13 OCTOBER

The 9th edition of the IGC Open Day took place in 2018. One hundred and fifty IGC researchers and staff took part in the event, showing the science we do, in many different activities. About 1500 visitors participated in scientific experiments, games and workshops for children, young people and adults; took a guided tour of the laboratories; participated in talks with scientists in the garden of the Palace of the Marquis of Pombal; met the model organisms used in science; and discovered the world of fluorescence. Art and Science activities were also present at this event with a creative corner for kids and groups of sketchers drawing some of our science.



Visitors doing hands-on activities during the IGC Open Day.

Open Day for University Students

22 NOVEMBER

Within the scope of the Science and Technology week, the IGC held the 2nd edition of the Open Day – Universities, an event dedicated to undergraduate students (BSc and MSc). Aimed at providing a complete vision on the research done at the IGC and training opportunities, the programme included 6 talks about the different research areas at the IGC; 3 round tables addressing training programmes, careers in science, and the technology behind science; visits to laboratories and facilities; and speed dating with scientists. Seventy IGC researchers and technicians interacted with 60 students that participated in this event.



Students attending a round table about career paths in science with IGC's staff.

Art & Science Projects

Artist in Residence: Alaa Abi Haidar

In December 2018, ALAgrApHY, artistic name of Alaa Abi-Haidar, initiated an artistic residence at the IGC. For a period of 6 months, his main project will be an artistic visualization of data generated by IGC scientists, using artificial intelligence.



New IGC artist in residence, Alaa Abi Haidar .

Collaboration in art installations

The art installation entitled 'The Origin of Species – Post Evolution – *Drosophila/Wolbachia*' is the result of a collaboration between the artist Marta de Menezes, the philosopher Maria Antónia Gonzalez Valerio, and the scientist Luís Teixeira, from IGC. This installation aims to demonstrate the limits of an interaction between *Drosophila melanosgaster* (fruit fly) and *Wolbachia*, a bacterium that naturally lives inside insect's cells. This piece was presented in the Edinburgh International Science Festival 2018.

Other Participations

Upon invitation from Maratona da Saúde association, two of our scientists went to a private social security institution in Lisbon to talk about autoimmune diseases and allergies to 50 senior citizens and children.

IGC scientists and science communicators also participated in public engagement initiatives promoted by the Calouste Gulbenkian Foundation (FCG). These included the Open Day of the FCG for University students and a Meeting with Teachers.



Fundraising 2018

The IGC runs fundraising initiatives with private companies, charities and the general public to raise private funds for science. The IGC is under the Scientific Sponsorship Law. This law provides tax benefits for science-related donations by either individuals or companies.

Major Projects

The IGC – Everything is New (EIN) Partnership: NOS Alive – IGC research fellowships

Since 2007, the IGC has a partnership with Everything is New, promoter of the NOS Alive music festival, that results in the IGC participation in this music festival and in two research fellowships per year that allow young graduates to start their scientific careers. In 2018, Joana Moreira da Silva and Beatriz Mourato received a fellowship to develop one-year research projects at the Disease Genetics, and at the Population and Conservation Genetics research groups, respectively. The practical works of these projects will be carried out during 2019 at the IGC, and in the UK and in France. Since 2008, over 500 young graduates around the country have applied to these fellowships, and 18 received a fellowship. In 2018, 5 NOS Alive-IGC alumni had already finished a PhD, 3 were conducting a Post-Doc abroad, 7 were doing a PhD, 1 was doing a Master and 3 were pursuing research projects.



NOS Alive - IGC alumni and Álvaro Covões (Managing Director of Everything Is New) at IGC stand in NOS Alive 2018 festival.

Coleção Ciência – A partnership between the IGC and Vista Alegre

A collection of porcelain products, *Coleção Ciência*, results from a partnership between the IGC and Vista Alegre, a prestigious and market leader Portuguese porcelain manufacturer. In 2018, the porcelain *Coleção Ciência* was available at the IGC and at the Calouste Gulbenkian Foundation.

Fundraising activities organised by the IGC PhD Delegates and Post-Doctoral Committee

Several fundraising activities (beer hours, thematic parties, etc.) were organised in 2018 to raise funds for the 12th PhD AMeeGuS meeting and for the Post-Doctoral retreat, via donations from attendees at the events, both from IGC staff and the general public.



Acknowledgements

We are grateful to everyone at the IGC - researchers, students and staff - who supplied information, text and images used in this report.

COORDINATOR

Ana Mena

EDITORS

Vanessa Borges Inês Bravo

LAYOUT AND DESIGN

Inês Bravo Inês Coimbra

ILLUSTRATIONS

Inês Bravo and Cirenia Baldrich (Cirenia Sketches).

PHOTOGRAPHY

Diana Ramos, FCG, Joana Loureiro, João Mata, Luís Ferreira, Roberto Keller, Sandra Ribeiro, Ana Lúcia Mena, Inês Bravo, Vanessa Borges, IVLP Organization Comittee and Kriolescope.

The Instituto Gulbenkian de Ciência (IGC) Annual Report is also available to download from the IGC website at: www.igc.gulbenkian.pt/annualreport

If you would like to receive a copy of this report, on a USB memory stick, please contact:

Science Communication and Outreach Instituto Gulbenkian de Ciência Tel: +351 440 7959

Fax: +351 440 7959

E-mail: scicomm@igc.gulbenkian.pt

This is an open access publication, and with the exception of images and illustrations, the content may, unless otherwise stated, be reproduced free of charge in any format or medium, subject to the following conditions: content must not be used in a misleading context, the IGC must be credited as the original author and the title of the document specified in the attribution.

First published by the Instituto Gulbenkian de Ciência, 2019

© Copyright Fundação Calouste Gulbenkian 2019

www.igc.gulbenkian.pt
NSTITUTO GULBENKIAN DE CIÊNCIA Bua da Quinta Grande, 6
Rua da Quinta Grando 6

Rua da Quinta Grande, 6 2780-156 Oeiras Portugal