Annual Report 2020

GULBENKIAN SCIENCE

Annual Report 2020

Index

INDEX

IGC Direction Statement

IGC **DIRECTION STATEMENT**

IGC Direction Statement

2020,A YEAR OF CHALLENGES AND OPPORTUNITIES

2020 was a year of challenges and accelerated change. The COVID19 pandemic shaped the year in science, from campus shutdowns and moving all our meetings to the virtual world, to scientists being daily in the news, to the breathtaking speed of deployment of science that led to the new mRNA vaccines. As scientists and citizens, it is now time to reflect on the lessons learnt from this recent transformation of our lives and which future we wish to build for science and society.

As the pandemics unfolded, the Gulbenkian Foundation was one of the first foundations to react, acting within its fields of intervention. IGC played an important part in this effort and we are very proud of our achievements. In early March 2020, while closing the institute for 6 weeks for all non-urgent activities, several IGCers generously volunteered and/or redirected their work for a large COVID task force led by Jocelyne Demengeot and Carlos Penha Gonçalves (see timeline on pages 24 and 25). From developing and implementing diagnostic tests and virus sequencing, to studying virus evolution and our immune response to it, it became clear that an Institution like the IGC, which focuses on fundamental basic research, has much to offer society not just through producing knowledge but also by helping to manage and solve immediate societal crises. In particular, the IGC´s collaborative spirit and diverse expertise in evolution, immunology, virology and its genomics facility were critical to help tackling this pandemic. As a result of those activities, IGC is responsible for more than 15% of all SARS-CoV-2 sequences in Portugal, has a large national cohort of people being followed to study the efficacy of vaccination, and implemented a screening strategy to identify infected people within the IGC using saliva. Our scientists were frequently interviewed by the media, organized and participated in webinars and other activities to fight the spread of misinformation, the other deadly "virus" that we are facing in this pandemic.

However, despite all these obstacles, we managed to make 2020 more than just ' the year of the pandemic'. 2020 was also a year of achievements in our science, as well as adapting and rethinking on how we want to do science. It was a good year for scientific recognition and grants successes: Caren Norden and Luis Teixeira were elected EMBO members. M João Amorim, Raquel Oliveira, Ricardo Henriques and Elias Barriga were awarded ERC grants and Miguel Soares was awarded the first ERC-Oeiras award.

However, 2020 also bore some sad news for all at IGC as we lost our colleague Alekos (see page 58), a very creative and generous colleague and friend that contributed to the work of so many at the IGC. We are forever grateful to Alekos for his generosity and will always remember him for his passion and insightfulness when discussing science.

For keeping the IGC running against all odds, one of the biggest challenges was to move internal and external meetings to the virtual or semi-virtual world. We needed to ensure cohesiveness, keep the IGC spirit alive and prevent further delays in our science. From communication to funding, biosecurity and training, all units found new strategies to contribute to the well-being of IGCers and to ensure the continuation of our activities, on top of contributing to society. Caren Norden, together with the training unit and the events team, organized a virtual SAB visit which was important for all members of IGC to keep the input of this important advisory body. They also organized the first ever virtual recruitment symposium that led to the recruitment of four new group leaders: Pablo Sartori, Marco Fumasoni, Giulia Ghedini and Waldan Kwong. An experience that we might even, in amended form, carry into the future. We hosted EMBO virtual meetings, defended virtual PhD thesis exams, and engaged in hybrid PhD classes. This was not easy, but forced us to test new and more sustainable and creative ways of running events. This type of adaptation was already part of our mid-term strategy and the pandemic for sure sped up its general implementation. We are now running hybrid events in our patio, from lab meetings to seminars, using new outdoor screens.

Another brighter side was that the pandemic accelerated many of our strategic goals defined in 2018. Those included networking with other international scientific organizations to accelerate discovery, as well as to better connect science with society towards science democratization. In 2020 we started to intensify our connection with EMBL and its large network of scientists and infrastructures, by starting a twinning networking grant headed by Luis Teixeira. We also signed a Memorandum of Understanding with EMBL towards strengthening our collaboration, a prospect we are very excited about. COVID19 led us to establish new and strengthened already existing links with hospitals and industry. We also created a BSL3 facility to study pathogenic organisms such as SARS-CoV-2. Through the leadership of a consortia (Serology-4Covid) composed of 5 Institutes in the life sciences in the Lisbon area, IGC licensed its first diagnostic test to a company.

While COVID19 highlighted the importance of communicating science to the lay public, it also exposed the long road ahead of us to make the benefits of science accessible to all. Science institutions, in collaboration with other societal stakeholders, have an important responsibility in promoting science democratization so that everyone can improve their health and well-being through science. In 2020, our projects to promote engagement with science sponsored by Gulbenkian, the Oeiras city council and MERCK family foundation engaged many pupils, teachers, citizens and scientists, including those from lower income countries. While the main mission of the IGC is without doubt its scientific one, which is understanding of the world within and around us, our societal mission has become even more relevant during this pandemic and will stay like this also beyond.

Organisation

Gulbenkian Science

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 goes through the Director, a managing Director, and two Deputy Directors for Science. The Director is responsible to respond to the FCG Board of Trustees. An eminent external Scientific Advisory Board oversees the scientific activities of the IGC, whereas the Ethics Committee ensures the ethical conduct of the scientific activities related to vertebrate animals or humans. The Scientific Advisory Board and the Ethics Committee are appointed by FCG Board of Trustees.

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Martin Essayan

José Neves Adelino

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Manuel Schmidt
Managing Director

Élio Sucena
Deputy Director for Science

Caren Norden
Deputy Director for Science

Scientific Advisory Board

The Scientific Advisory Board comments and consults on the scientific progress, graduate programmes, recruitment and overall performance of staff and research groups, advising the Board of the Gulbenkian Foundation on all matters related to the mission of the Institute.

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ORGANIGRAM

CALOUSTE GULBENKIAN FOUNDATION

BOARD OF DIRECTORS

SCIENTIFIC ADVISORY BOARD
Herbert Jaeckle
(Chairperson)

OMBUDSOFFICE

DIRECTION

Mónica Bettencourt–Dias
Director

Manuel Schmidt
Managing Director

Caren Norden
Deputy Director

Élio Sucena
Deputy Director (until September)

29 RESEARCH GROUPS

10 CORE FACILITIES

12 SERVICES

IGC in Numbers

IGC in Numbers

IGC IN NUMBERS

PEOPLE
394
F 235 | M 156

RESEARCHERS
254
F 157 | M 97

GROUP LEADERS
29
F 12 | M 17

MASTER STUDENTS
28
F 6 | M 22

PhD STUDENTS
87
F 52 | M 35

POSTDOCS
101
F 66 | M 35

VISITORS
32
F 6 | M 22

10 CORE FACILITIES
12 SERVICES

COLLABORATIONS WITH OTHER INSTITUTIONS:
81 National **131** International

NATIONALITIES 46 /
PORTUGUESE 71 %/
INTERNATIONAL 29 %/

131 PUBLICATIONS

959 IN THE LAST 7 YEARS

12 / **THESES IN 2020**
02 BSc
05 MSc
05 PhD

18.100 K€
Funding 2020

52% Core funding / **48%** External funding

24 PRIZES & HONOURS

SEMINARS & MEETINGS
46 National
63 International

246 TALKS ORGANIZED
58 National
188 International

158 NUMBER OF PROJECTS

14 EU funding
49% FCT funding
18% International funding
18% Other

37 NEW PROJECTS IN 2020

2020 **TIMELINE**

January

NEW CALL FOR GROUP LEADERS

'CHROMOSOME DANCE' BY RAQUEL OLIVEIRA SCIENCE ON STAGE WITH GULBENKIAN MUSIC.

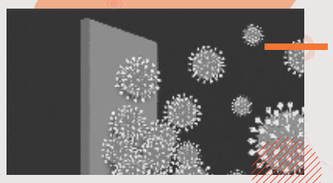
SERIES OF CONCERTS WITH SCIENCE WHERE ALSO PARTICIPATED LOUNÈS CHIKHI & RUI OLIVEIRA.

February

IGC ORGANIZES THE FIRST CITIZEN ASSEMBLY WITH THE OEIRAS CITY COUNCIL

ANTONIO COUTINHO FELLOWSHIPS AWARDS CEREMONY

March



SARS-CoV-2 REACHED PORTUGAL AND LOCKDOWN STARTED

IGC WINS ACCESS CULTURE AWARD FOR SCIENCE ALIVE EXHIBITION

ISABEL GORDO AND KARINA XAVIER ELECTED AS NEW MEMBERS OF THE EUROPEAN ACADEMY OF MICROBIOLOGY

April

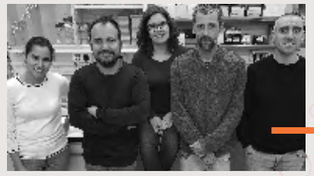
"la Caixa" Foundation

ELIAS BARRIGA AWARDED WITH A "LA CAIXA" FOUNDATION JUNIOR LEADER FELLOWSHIP

IGC PROVIDES RESOURCES TO HOSPITALS DURING THE PANDEMIC

SEROLOGY4COVID CONSORTIUM LED BY IGC DEVELOPS SEROLOGICAL TRIAL FOR THE PORTUGUESE POPULATION

IGC STARTS COVID-19 PREVALENCE STUDY IN HEALTHCARE PROFESSIONALS



FIRST SARS-COV-2 VIRUS SEQUENCED AT IGC

May

VIRTUAL SAB MEETING TOOK PLACE FOR THE FIRST TIME IN THIS FORMAT.

OPENNING

HOW DO PLANTS GROW, NATURE CELL BIOLOGY PAPER FROM JORG BECKER REVEALS MORE INFORMATION ON THE CAPACITY OF PLANTS, IDENTIFIED AS "EPIGENETIC MEMORY"

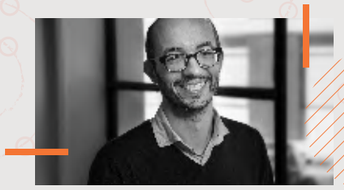
June

NATIONAL SEROLOGICAL ROADMAP PROPOSED BY IGC

2020 **TIMELINE**

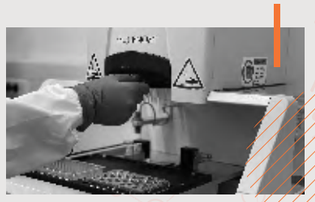
July

CAREN NORDEN AND LUÍS TEIXEIRA ARE THE IGC RESEARCHERS ELECTED EMBO MEMBERS IN 2020



GROUP OF RESEARCHERS, FROM SIX COUNTRIES, INCLUDING LOUNÊS CHIKHI, IDENTIFIED A NEW POPULATION OF MOUSE LEMURS (MICROCEBUS) THAT INHABIT THE MADAGASCAR FORESTS

VERA MARTINS, IDENTIFIED A GROUP OF CELLS THAT REGULATES THE DEVELOPMENT OF A PARTICULAR TYPE OF CELLS OF THE IMMUNE SYSTEM – THE T LYMPHOCYTES.
STUDY PUBLISHED IN CELL REPORTS.



RESULTS OF THE SEROLOGICAL STUDY IN ALMEIRIM TO DETERMINE WHETHER THE POPULATION HAD BEEN EXPOSED TO THE SARS-COV-2 VIRUS.

September

ELIAS BARRIGA AWARDED WITH EUROPEAN RESEARCH COUNCIL STARTING GRANT

PABLO SARTORI AND RICARDO HENRIQUES STARTED THEIR LABS AT IGC

October

ANTONIO COUTINHO SCIENCE AWARDS GO TO STUDENTS FROM MOZAMBIQUE AND CAPE VERDE.

GULBENKIAN FOUNDATION AND CUF ESTABLISH A SCIENCE AND TRAINING PARTNERSHIP.

PROTOCOL PROVIDES FOR THE EXCHANGE OF KNOWLEDGE, TRAINING AND RESEARCH IN THE FIELDS OF HEALTH AND SCIENCE

November

IGC LAUNCHES THE VIRTUAL OPEN DAY

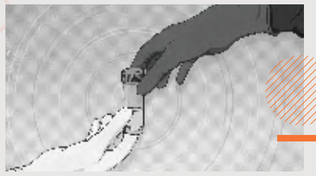
LAB IN A BOX
STARTS OEIRAS
TEACHERS TRAINING

OEIRAS MUNICIPALITY AND GULBENKIAN LAUNCH ERC-OEIRAS

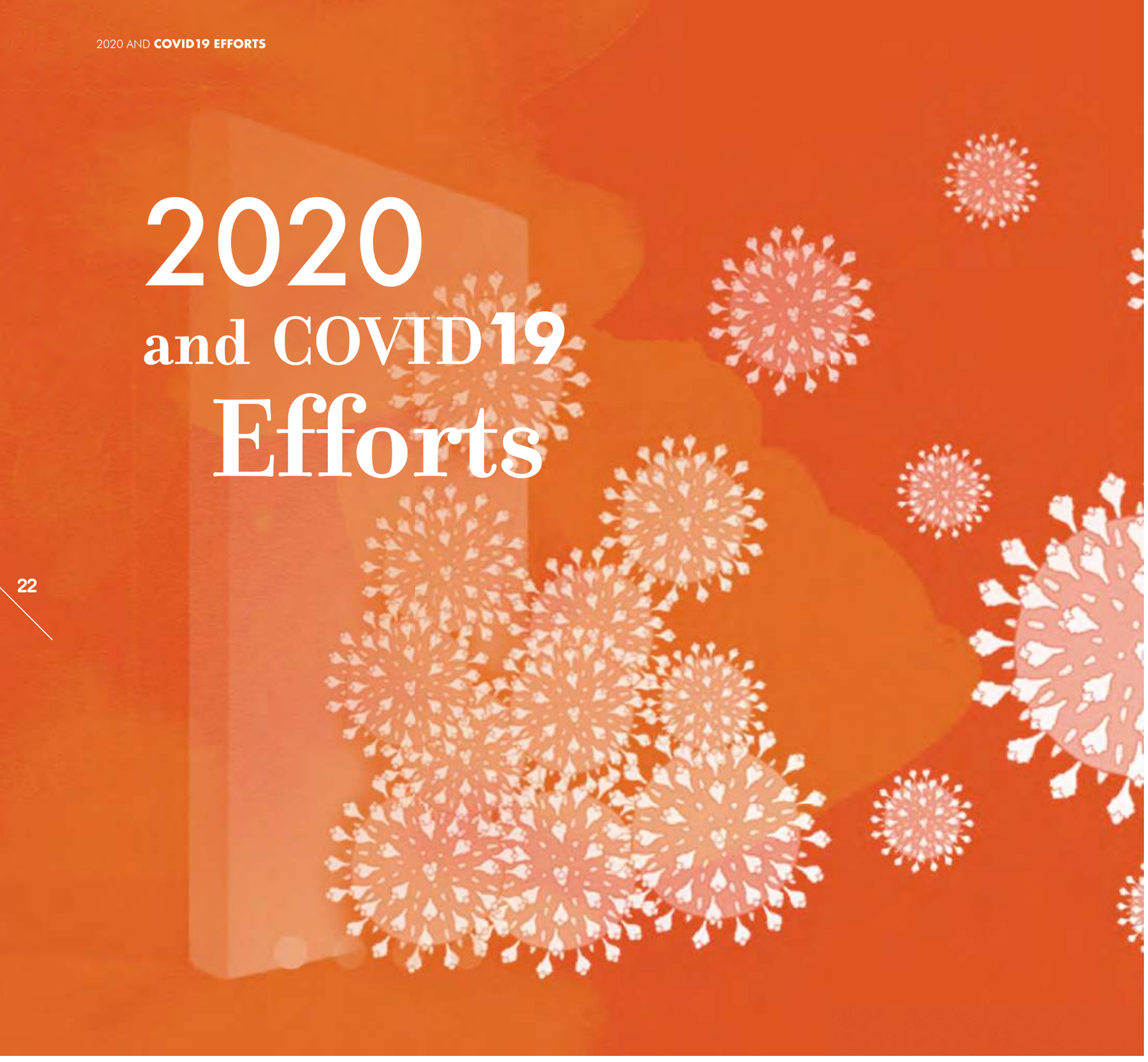
December

SEROLOGY4COVID TEST LICENCING APPROVED

MARIA JOAO AMORIM
RAQUEL OLIVEIRA AND
RICARDO HENRIQUES
AWARDED WITH
ERC GRANT



IGC RELEASES
SALIVA TEST
STUDY



2020 and COVID19 Efforts

2020 AND **COVID19 EFFORTS**

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2020 AND COVID19 EFFORTS

-

An atypical year, completely dominated by science.

An invisible, silent element, moving at an unprecedented speed, with worldwide repercussions at the socio-economical, environmental, and public health levels, seemed like a foretold future.

It arrived in the end of 2019 and changed our lives forever.

A virus that managed to mobilize the whole scientific community, on an unprecedented demand.

Along the year

MORE THAN 70 IGC VOLUNTEER'S SCIENTIST HELPED WITH COVID TASKS AND RESEARCH.

THE IGC PARTICIPATED IN THE NEGOTIATION OF MORE THAN 70 AGREEMENTS, AMONG WHICH WERE SCIENTIFIC AND TECHNOLOGICAL COLLABORATIONS WITH HOSPITALS (CHLO, HOSPITAL FERNANDO DA FONSECA, HOSPITAL D. ESTEFÂNIA, CUF, AMONG OTHERS) AND COMPANIES.

January

– OFFICIAL DECLARATION OF PUBLIC HEALTH EMERGENCY.

February

– THE IGC GENOMIC UNIT STARTED THE PREPAREDNESS PLAN TO RESPOND TO THE PUBLIC HEALTH EMERGENCY. REAGENTS START TO FAIL AND ALTERNATIVES WERE NECESSARY.

March

– FIRST CASES MARKED THE PORTUGUESE AGENDA. LOCK DOWN WAS DECLARED AND IGC SCIENTISTS ASSEMBLED A VOLUNTEER COVID TASK FORCE LED BY JOCELYNE DEMENGEOT AND CARLOS PENHA GONÇALVES. IGC SCIENTISTS INTEGRATED LABORATORIES OF HOSPITALS AND ENSURED AN INCREASED TESTING CAPACITY. IGC PERFORMED OVER DIAGNOSTIC PCR 10 000 TESTS.

– THE IGC MADE AVAILABLE INDIVIDUAL PROTECTION EQUIPMENT THAT WAS IN SHORTAGE TO THE ADMINISTRAÇÃO REGIONAL DE SAÚDE DE LISBOA E VALE DO TEJO, ALLOWING HOSPITALS TO RESPOND TO THE HIGH DEMAND FELT AT THE TIME.
THE CALOUSTE GULBENKIAN FOUNDATION CREATED A 5 MILLION EUROS EMERGENCY FUND TO SUPPORT FIVE AREAS: HEALTH, SCIENCE, CIVIL SOCIETY, EDUCATION AND CULTURE.

April

– CREATED THE SEROLOGY4COVID CONSORTIUM, LED BY IGC AND GATHERING OTHER 4 RESEARCH CENTERS: IMM, CEDOC-NMS, ITQB NOVA AND IBET, TO IMPLEMENT A COVID-19 SEROLOGICAL TEST TO BE USED WIDELY AT A NATIONAL LEVEL.

– THE FIRST SAMPLES OF THE SARS-COV-2 VIRUS WERE SEQUENCED AT THE IGC AND IN LITTLE OVER SEVEN MONTHS MORE THAN 600 VIRUSES ANALYZED. A PROCESS THAT WAS BUILT WITH HEALTH AUTHORITIES, OPTIMIZING THE TECHNOLOGICAL PLATFORMS AND POTENTIATING NATIONAL AND INTERNATIONAL COLLABORATION.

– LAUNCHED THE COLIFE WEBSITE WITH THE GOAL OF SHARING CREDIBLE INFORMATION ABOUT THE COVID-19 PANDEMIC IN A DYNAMIC, USEFUL AND ACCESSIBLE WAY FOR BOTH SCIENTISTS AND THE GENERAL PUBLIC. A SOCIAL MEDIA CAMPAIGN WAS RUNNING TO REINFORCE COMMUNICATION TO THE PUBLIC.

May

– RESEARCHERS AT IGC AND ALL OVER THE WORLD SET THEIR EYES ON THE GENOME OF THE VIRUS AND SAMPLED IT PERIODICALLY AND IN AN UNINTERRUPTED WAY, TRACKING ITS STEPS.
SARS-COV-2 PROVED TO BE THE TRUE EVOLUTIONIST'S NIGHTMARE AND THEIR EYES WERE SET ON THIS PROCESS.

– THE IGC STARTS COVID-19 PREVALENCE STUDY IN HEALTHCARE PROFESSIONALS IN 4 HOSPITALS IN THE LISBON AREA: AROUND 1500 PARTICIPANTS WERE MONITORED OVER A YEAR TO IDENTIFY IF THEY HAD BEEN INFECTED BY SARS-COV-2 VIRUS.

– SERIES OF 3 WEBINARS CYCLE NAMED *VARIABLE NEW WORLD* LAUNCHED TO EXPLORE THE CONNECTION BETWEEN SCIENCE AND SOCIETY AS A FUNDAMENTAL TOOL TO OVERCOME THE COVID19 CRISIS AND TO BUILD A NEW MORE SUSTAINABLE REALITY.

June

– NATIONAL SEROLOGICAL ROADMAP PROPOSED BY 20 SCIENTISTS. THE PROPOSAL, LED BY IGC, SUGGESTED A CLOSE COORDINATION BETWEEN PUBLIC ENTITIES AND OTHER PARTNERS, ENSURING A ROBUST RESPONSE OF THE COUNTRY TO THE PANDEMIC.

July

– SEROLOGICAL STUDY CARRIED OUT IN ALMEIRIM. RESULTS REVEALED A NUMBER OF CASES OF UNKNOWN ASYMPTOMATIC INFECTIONS, AS WELL AS LOW PREVALENCE OF INFECTION AMONGST HEALTH PROFESSIONALS TESTED (1%).

August

– IGC RELEASES PODCAST ABOUT THE SCIENCE OF THE NEW CORONAVIRUS IN COLLABORATION WITH CAPE VERDE'S AFRICA SCIENCE WEEK IN THE AFRICAN PORTUGUESE-SPEAKING COUNTRIES (PALOP).
A COMMUNICATION EFFORT AIMING AT DISSEMINATING PREVENTION GUIDELINES.

September

– COVID-19: SALIVA AS A DIAGNOSTIC SAMPLE. RESEARCHERS FROM THE IGC, IN PARTNERSHIP WITH HOSPITAL DONA ESTEFÂNIA AND HOSPITAL AMADORA SINTRA STARTED TO STUDY THE FEASIBILITY OF USING SALIVA AS AN EFFECTIVE SAMPLING FOR DETECTING COVID-19 INFECTION IN ADULTS AND CHILDREN.

October

– MORE THAN 10 PROJECTS FOCUSED ON SEEKING ANSWERS TO BE ONE STEP AHEAD OF THE VIRUS CONTINUED AT THE IGC. STUDIES TO UNCOVER THE EVOLUTION OF THE VIRUS, THE VIRUS´ EFFECTS ON THE BODY BOTH IN SHORT AND LONG TERM, AND TO UNDERSTAND HOW THE IMMUNE SYSTEM REACTS TO NATURAL INFECTION, AND HOW LONG DOES THAT RESPONSE LASTS FOR.

November

– IGC LAUNCHED THE VIRTUAL TOUR TO TAKE ADVANTAGE OF THE SCIENCE EXPOSURE AND TO ALLOW THE SOCIETY TO GET TO KNOW MORE ABOUT RESEARCH AND THE SCIENTIFIC PROCESS BEHIND FUNDAMENTAL RESEARCH.

December

– *SEROLOGY4COVID* CONSORTIUM CLOSED LICENSING AGREEMENT FOR THE SEROLOGICAL TESTS TO MEDINFAR, LEADER IN THE AREAS OF CONSUMER HEALTHCARE AND DERMATOLOGY. AT THE SAME TIME, THE PROTEIN AND THE PROTOCOL BECAME AVAILABLE TO RESEARCH CENTERS IN PORTUGAL AND IN PORTUGUESE SPEAKING AFRICAN COUNTRIES (PALOP) INTERESTED IN DEVELOPING ACADEMIC STUDIES ON THE SARS-COV-2 VIRUS.

– THE FIRST VACCINE AGAINST COVID-19 WAS AUTHORIZED.

– SARS-COV-2 VACCINE EFFECTIVENESS STUDY: IGC STARTS TO FOLLOW DIFFERENT POPULATIONS. THIS DATA COLLECTION WAS RECOMMENDED BY THE WORLD HEALTH ORGANIZATION TO MONITOR THE INTRODUCTION OF THE NEW VACCINE INTERNATIONALLY.

Every day the future is written, with the courage, creativity, and perseverance of all scientists of IGC. THANK YOU TO ALL OF THEM!

Science Stories 2020

SCIENCE STORIES 2020

Science Stories

FIGHTING MICROBES WITH MICROBES

The findings published on **Nature Microbiology**, revealed that the presence of the low abundant bacterium, member of the microbiota, *Klebsiella michiganensis* was sufficient to explain the resistance to invasion by other bacteria like *E. coli* or *Salmonella* because it can metabolize nutrients available in the intestine more efficiently, competing against potential invaders and preventing the entry of other bacteria that can harm the host.

The increasing consumption of antibiotics is a public health problem that can compromise the effectiveness of future treatments, highlighting the importance of the identification of bacteria and mechanisms that can minimize the negative effects associated with their consumption. Karina Xavier, leader of the IGC research group responsible for the study, reinforces that "in the future, what is desirable is that anytime we use antibiotics we also take complements that can restore the microbiota and potentiate the beneficial effects it entails. For that, the identification of super competitive bacteria like this one is essential".

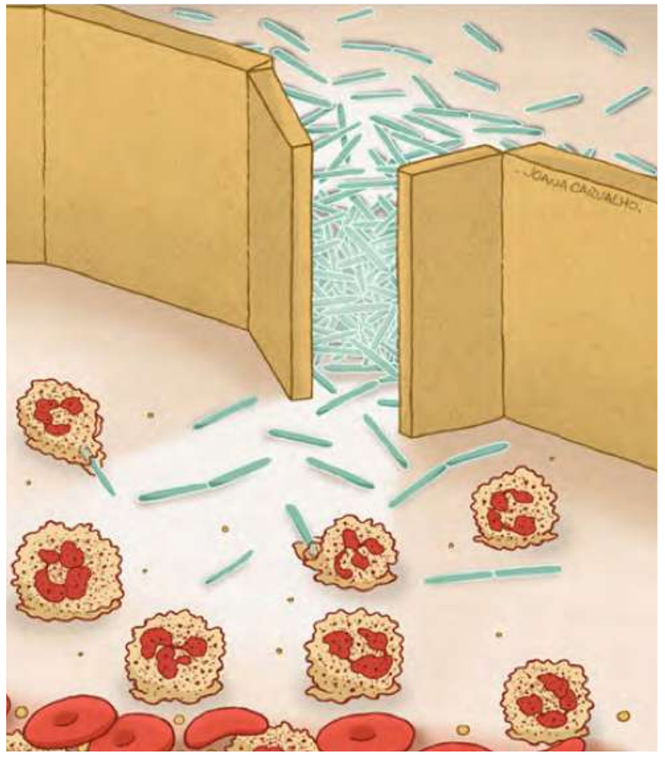
STUDY PROPOSES "MICROBIAL NOAH'S ARK" PILOT PROJECT

A new study finds that proposal to create a **"microbial Noah's ark"** to protect the long-term health of humanity is feasible and should move forward into a **pilot project phase**, that would include installing infrastructure to store microbes in a site such as Norway or Switzerland and a collaboration for collecting samples all over the world. The Rutgers University's initiative will give an important contribute to the **health of future generations**, safeguarding **microbe's diversity**. Karina Xavier and Luís Teixeira, principal investigators at Instituto Gulbenkian de Ciência, integrate the scientific experts panel and will promote the collaboration with Portuguese-Speaking countries in the sample collection process. **Instituto Gulbenkian de Ciência** will have a decisive role on two fronts: by contributing with the scientific knowledge production in this research area and by enhancing the networks developed over the years by IGC's Science for Development Programme, an advanced training programme for researchers from Portuguese-Speaking Countries in Africa and Brazil.

HORMONE INVOLVED IN OBESITY IS A RISK FACTOR FOR SEPSIS

A group of scientists, led by Luís Moita, discovered that a hormone that has been pointed out as a treatment for obesity reduces the resistance to infection caused by bacteria and is a risk factor for sepsis. The work developed in collaboration with researchers from France, Germany and South Korea was published in the scientific journal Proceedings of the National Academy of Sciences USA.

Sepsis is a potentially fatal illness, that derives from a deregulated response of the organism to an infection, leading to organ malfunction. With the aim of expanding knowledge about this disease, researchers investigated whether the hormone known as **GDF15** (growth and differentiation factor 15) could play a role in sepsis. This hormone has the specificity of being widely studied by several laboratories and pharmaceuticals as a treatment for obesity. "We've discovered a critical effect of GDF15 on infection, which is relevant because this hormone increases in many common diseases, like obesity, pulmonary and cardiovascular diseases", explained Luís Moita. IGC researcher says that "they raise the possibility that the inhibition of GDF15's action, perhaps using a blocking monoclonal antibody, could work as a new complementary therapy for sepsis, helping to control severe local infections and preventing it to become systemic and life-threatening".



NEW DISCOVERIES ON LEUKEMIA

Researchers led by Vera Martins, identified a group of cells that regulates the development of a particular type of cells of the immune system – the T lymphocytes. The study published in Cell Reports demonstrates that the development of T lymphocytes lays on the coordination of signals followed by cells in order to ensure the maintenance of a healthy organism. The cells identified in the study integrate information regarding the needs of more mature cells and define their own development accordingly: adjusting the speed of the production of T lymphocytes and purging the system of other less efficient cells, that tend to cause leukaemia.

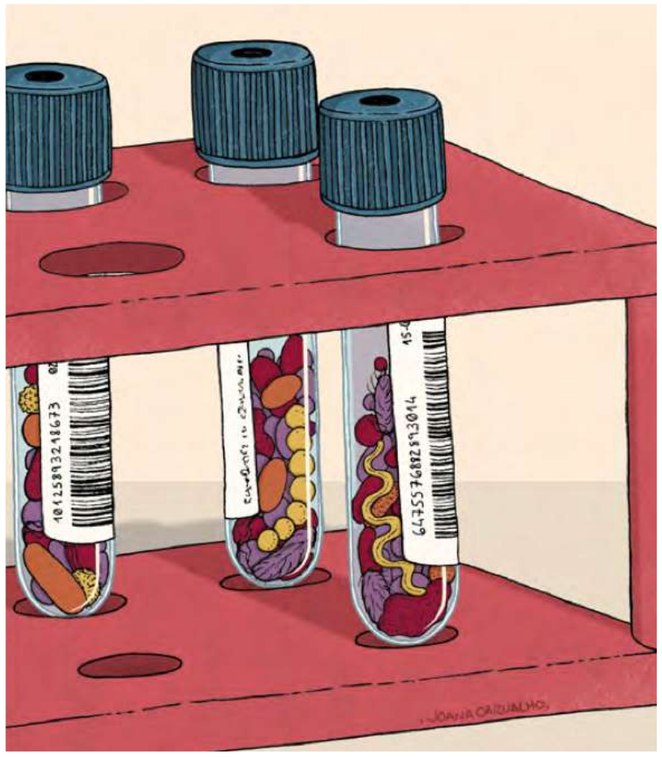
ANTIBIOTIC RESISTANCE AND THE NEED FOR SPECIALIZED TREATMENTS

Study reveals that individual microbiota determines the maintenance of antibiotic-resistant bacteria in the gut.

Researchers led by Isabel Gordo have found that the microbiota of each individual determines the maintenance of antibiotic-resistant bacteria in the gut: whereas in some individuals resistant bacteria are quickly eliminated, in others they are not. The study, published in **Nature Ecology and Evolution**, reinforces the need to implement more personalized therapies and offers new insights to the paradigm of the evolution of antibiotic resistance in the gut.

Till now, much of what is known about this process relies on studies in artificial systems, that give an incomplete overview of the phenomenon's complexity. In order to fill this gap, researchers used mice to observe that in the gut after the antibiotic intake, the competition for survival of resistant bacteria has different dynamics overtime, depending on the host. The same resistance has different interactions which determine which lead to resistant bacteria with low survival capacity in the absence of antibiotics in one individual and to bacteria with high survival capacity in another individual.

The next steps of this research will be aimed at "finding the Achilles heel of resistant bacteria in the gut, a study we are carrying out in several levels" said Isabel Gordo, "at least one of the hypothesis is showing great results: even when they colonize the gut in a less ideal condition we are being able to eliminate them faster!".



GENETICS OR SOCIAL ENVIRONMENT: WHO WINS IN THE INFLUENCE OF BEHAVIOURS?

Researchers discovered that the social environment in which the individual develops can revert genetic effects of its behaviour, something particularly important to take into account when experiments resort to **genetically modified** animals. The study published in ELife analysed behaviours associated with oxytocin, one of the known "happy hormones", and showed that these can be reverted in the individual, with or without oxytocin, depending on the social group it interacts with.

Researchers led by Rui Oliveira studied the role of oxytocin, an important molecule for the regulation of social bonding. Using the zebrafish *(Danio rerio)*, they aimed at understanding how social genetic effects impact the interaction between the individual and the social environment or, in this case, the shoal. For that purpose, the team used two kinds of zebrafish: ones similar to the ones found in nature and others in which the oxytocin gene was removed, thus rendered no longer functional. The results show that both the social preference and social integration and influence change depending on whether the shoal has oxytocin or not. On the contrary, it's the genetic features of the individual that determine the ability to create memories and therefore distinguish between different shoals. These results have a special relevance when experimental models are designed by editing genes.

New Research groups

NEW RESEARCH **GROUPS**

New Research Groups

Ricardo Henriques and Pablo Sartori come to strengthen the study in New Technologies in Cell Biology and Mathematics Applied to Biology at the IGC, in line with the new scientific strategy in progress.

Ricardo Henriques, with a background in physics, soon engaged with Biology. He arrived at the IGC coming from University College London (UCL) with a portfolio of technological tools widely used by the world scientific community. Ricardo comes to lead the research group focused on the development of new technologies that make it possible to understand cell biology and biophysics.

Pablo Sartori studied Physics at the University of Granada and soon after moved to the IBM laboratory in New York where he took his first steps in biophysics. He studied at the Max Planck Institute for the Physics of Complex Systems (MPI-PKS) in Dresden, and, following his interest in discovering more about proteins, he joined Rockefeller University in NYC where he made his postdoc. In 2020, he arrived at the IGC to lead a new research group dedicated to the study of mathematical processes associated with biological phenomena.

GROUP NAME

OPTICAL CELL BIOLOGY

RESEARCH GROUP LEADER

Ricardo Henriques

Research Interests: the Henriques group focuses on addressing biomedical questions by exploiting advancements we develop in optical microscopy. To do so, the research team creates open-technology that pushes the boundaries of cellular imaging. All their research and methods are transparent, reproducible and widely available to researchers. In biology, researchers tackle broad virology, host-pathogen interactions, immunology and cell signalling questions. Researchers do so by establishing new classes of fluorescent probes, high-speed cell-friendly super-resolution methods and computational modelling approaches that, although designed to answer questions of interest in the lab, have extensive cross-disciplinary applications.

/ HIGHLIGHTS IN 2020

Established the laboratory at IGC;
awarded ERC Consolidator and EMBO Installation Grant.

LAB MEMBERS IN 2020

Christoph Spahn (EMBO Short-Term Fellowship Postdoc), Visitor
Hannah Heil (Postdoc since 2020), Postdoc
Mario Del Rosario (Postdoc since 2020), Postdoc

PUBLICATIONS

1. Dey, G. et al. Closed mitosis requires local disassembly of the nuclear envelope. Nature 585, 119–123 (2020)

2. Pereira, P. M., Gustafsson, N., Marsh, M., Mhlanga, M. M. & Henriques, R. Super-beacons: Open-source probes with spontaneous tuneable blinking compatible with live-cell super-resolution microscopy. Traffic 21, 375–385 (2020)

3. Risa, G. T. et al. The proteasome controls ESCRT-III–mediated cell division in an archaeon. Science 369 (2020)

SOFTWARE DEVELOPMENT

ZeroCostDL4Mic (https://github.com/HenriquesLab/ZeroCostDL4Mic)

NETWORKS

Co-Directorship of the UCL-Wellcome Trust PhD programme

HONOURS

Award of Honorary Professor title at UCL, UK

RUNNING GRANTS

Wellcome Trust Collaborative Award at UCL

NEW GRANTS IN 2020

ERC European Research Council Grant
EMBO Installation Grant
EMBO Workshop on Computational Optical Biology

GROUP NAME

LIVING PHYSICS

RESEARCH GROUP LEADER

Pablo Sartori

Research Interests: Functionality is at the core of our understanding of biological systems. In contrast, inert physical systems lack this sense of function. Accounting for biological function thus requires a new kind of the living physics research group explains biological phenomena by exploring new regimes of statistical physics, mechanics and thermodynamics.

These are some general questions that the research group addresses:

• How are functions embedded in biological matter? For instance, how do proteins find correct partners in the heterogeneous cellular environment?

• What determines the characteristics that organisms evolve? Why some organisms evolve sensory response, whereas others evolve stochastic response?

• What are the main constraints to biological functionality? The laws of thermodynamics, the genetic code, the finite size of the proteome?

Research groups

Research Groups

29 RESEARCH GROUPS

F 12 / M 17

254 RESEARCHERS

F 157 / M 97

COLLABORATIONS

NATIONAL **82** INTERNATIONAL **131**

SABBATICALS

5

TALKS

NATIONAL **29** INTERNATIONAL **57**

GROUP NAME

PLANT MOLECULAR BIOLOGY

RESEARCH GROUP LEADER

Paula Duque

Research Interests: In Paula Duque´s lab researchers use Arabidopsis thaliana as a model system to investigate how plants perceive and respond to environmental stress at the molecular level, focusing on two lines of work: (1) the role of alternative splicing, a key posttranscriptional mechanism likely to contribute to the stress tolerance essential for plant survival and (2) roles for transporters of the Major Facilitator Superfamily (MFS) in plant abiotic stress responses (the functional analysis of these membrane proteins has also revealed striking examples of the biological impact of alternative splicing in plants).

/ HIGHLIGHTS IN 2020

The lab ongoing work aims to analyse the physiological roles of the conserved SR protein family of key modulators of alternative splicing and to uncover the extent of the contribution of the MFS to plant stress tolerance. In 2020, researchers discovered that: (1) loss of function of the three members of the RSZ subfamily of SR proteins causes reduced sensitivity to the abscisic acid (ABA) stress hormone during early seedling development, (2) loss of function of SR45, which we previously showed negatively regulates ABA signaling during early seedling development, results in hyposensitivity to ABA during seed germination and has opposing effects on the global transcriptome at the two developmental stages, (3) the early land plant model, the moss Physcomitrella patens, expresses 16 SR proteins that fall into the six described subfamilies and represent counterparts of well-established members in Arabidopsis and rice and (4) a novel MFS transporter, NPF5.9 is a heavy metal detoxifier under iron deprivation.

LAB MEMBERS IN 2020

Clarisse Zigue, MSc
Alba Rodríguez-Díez (IBB 2016), PhD Student
Rui Martins (Plants for Life 2017), PhD Student
José Pedro Melo (Plants for Life 2018), PhD Student
Romana Yañez (IBB 2019), PhD Student
Dóra Szakonyi, Postdoc
Tom Laloum, Postdoc
Esther Novo-Uzal, Postdoc
Guiomar Martín, Postdoc
María Niño-González, Postdoc

PUBLICATIONS

1. Melo J.P., Kalyna M., Duque P. (2020) Current Challenges in Studying Alternative Splicing in Plants: The Case of Physcomitrella patens SR Proteins. FRONT PLANT SCI 11: 286. DOI:10.3389/fpls.2020.00286.

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia

NEW GRANTS IN 2020

FCT Fundação para a Ciência e Tecnologia

GROUP NAME

PATTERNING AND MORPHOGENESIS

RESEARCH GROUP LEADER

Moises Mallo

Research Interests: Understanding the mechanisms of vertebrate axial extension; understanding the mechanisms regulating the transition from head to trunk development in vertebrates; understanding the role of Tgfbr1 signalling in the activation of the trunk to tail transition in vertebrates; understanding the principles governing body plan diversity among vertebrates and understanding what controls whether the cloacal mesoderm makes external genitalia or legs, and the mechanisms regulating anatomical diversity in this area.

/ HIGHLIGHTS IN 2020

Researchers from Moises Mallo´s lab have shown that Tgfbr1 signalling is essential to trigger tail bud formation by activating an incomplete epithelial to mesenchymal transition (EMT); Snai1 is essential to complete the incomplete EMT that generates the tail bud; Epha1 is a marker of neuromesodermal progenitors entering mesodermal fates; Tgfbr1 signalling is essential to establish the balance between making legs or external genitalia from the cloacal region and that the DIX domain of Axin2 is essential to build the mouse female genital tract.

LAB MEMBERS IN 2020

André Dias (IBB 2017), PhD Student
Anastasiia Lozovska (IBB 2017), PhD Student
Patrícia Duarte (IBB 2018), PhD Student
Triin Tekko, Postdoc
Ana Casaca, Lab Manager

PUBLICATIONS

1. Mallo, M. (2020). The vertebrate tail: a gene playground for evolution. Cellular and Molecular Life Sciences 77,1021–1030.

2. Dias, A., Lozovska, A., Wymeersch, F.J., Nóvoa, A., Binagui-Casas, A., Sobral, D. Martins, G.G., Wilson, V. & Mallo, M. (2020). A Tgfbr1/Snai1-dependent developmental module at the core of vertebrate axial elongation. eLife 9, e56615

3. de Lemos, L., Dias, A., Nóvoa, A. & Mallo, M. (2020). Epha1 is a cell surface marker for neuromesodermal progenitors and their early mesoderm derivatives. BioRxiv, 584524"

RUNNING GRANTS

PTDC/BIA-BID/30254/2017: Evaluating the switch in cellular competence during the head to trunk transition.

EVENTS ORGANIZED

Workshops | EMBO workshop on Neuromesodermal Progenitors in Development, Evolution and Regeneration, September 8-12, 2020, virtual from Lisbon (Portugal).

GROUP NAME

LYMPHOCYTE PHYSIOLOGY

RESEARCH GROUP LEADER

Jocelyne Demengeot

Research Interests: Regulation of immune responses; tumour immunity; autoimmunity.

/ HIGHLIGHTS IN 2020

Highlights in 2020: The lab concluded a series of investigation about immune tolerance and tumour culminating with 2 publications from José Santos work who was PhD student until 2019. Coordination of hCOVID at IGC was our other main achievement of the year.

LAB MEMBERS IN 2020

José Santos, Visitor
Daniel Sobral, Visitor
Vital da Silva (IBB 2015), PhD Student
Eleonora Tullumelo (IBB2015), PhD Student
Mayra Lopez (IBB2018), PhD Student
Iris Caramalho (Study monitor COVID19), Postdoc
Ligia Deus (Study monitor COVID19), Postdoc
Onome Akpogheneta (Researcher COVID), Postdoc
Ana Brennand (Researcher (COVID), Postdoc
Paula Matoso, Technician
Patricia Borges, Technician
Vanessa Correia, Technician
Marie-Louise Bergman, Lab manager

PUBLICATIONS

1. Interruption of Thymic Activity in Adult Mice Improves Responses to Tumor Immunotherapy. Almeida-Santos J, Bergman ML, Cabral IA, Demengeot J. J Immunol. 2021 Jan 20:ji2000626. doi: 10.4049/jimmunol.2000626. Online ahead of print.

2. LRBA deficiency: a new genetic cause of monogenic lupus. Liphaus BL, Caramalho I, Rangel-Santos A, Silva CA, Demengeot J, Carneiro-Sampaio MMS. Ann Rheum Dis. 2020 Mar;79(3):427-428. doi: 10.1136/annrheumdis-2019-216410. Epub 2019 Dec 18.

3. The multifaceted Foxp3fgfp allele enhances spontaneous and therapeutic immune surveillance of cancer in mice.

4. Almeida-Santos J, Bergman ML, Amendoeira Cabral I, Correia V, Caramalho Í, Demengeot J. Eur J Immunol. 2020 Mar;50(3):439-444. doi: 10.1002/eji.201948251.

RUNNING GRANTS

Medinfar-POR2020 & FCT COVID various in collaboration Association Française contre les Myopathies

NEW GRANTS OBTAINED IN 2020

Medinfar-POR2020 (COVID); CCDR COVID; FCT COVID19

COVID-19 RESEARCH

Susceptibility to infection and to severe disease

/ COVID-19 HIGHLIGHTS

Initiated and co-coordinated with Carlos Penha Gonçalves hCOVID@IGC, a platform allowing diverse investigations related to COVID19 in humans. Developed and scaled up an Elisa assay that allowed the regular monitoring of >2000 individuals since April 2020.

STAFF INVOLVED:

Marie Louise Bergman, Paula Matoso, Patricia Borges, Lígia Deus, Onome Akpogheneta, Vanessa Correia, Ana Brennand

OUTCOMES:

Coordinate hCOVID at IGC. provide support and structure to PCR testing, serology testing, develop and scale up an Elisa, transfer Elisa to private, assist private in commercialisation. Monitor >1000 health care workers and 500 citizens. Address genetic of severe disease, including hospitalised and ICU patients. Initiate saliva testing. Collaborate on Neutralisation assays. Animated video conference at IGC. Applied to multiple grants to support these activities. Produced slides and text, replied to journalists to distribute knowledge related to these activities.

ALLIANCES INVOLVED

Serology4COVID

PATENTS AND PROTOTYPES

ELISA COVID

GROUP NAME

PLANT GENOMICS

RESEARCH GROUP LEADER

Jörg Becker

Research Interests: The Plant Genomics group is interested in mechanisms controlling sexual reproduction and early embryogenesis. The research team is primarily studying these processes in two plant model species: The angiosperm *Arabidopsis thaliana* and the bryophyte *Physcomytrium patens*. A particular focus of their 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, accompanied by alterations in their epigenetic landscape with far-reaching implications for transposon silencing and transgenerational inheritance. The research team is analysing how these changes come about and what are their potential consequences after fertilisation. Bryophytes were among the first colonisers of land. Based on the expectation that some key components have been evolutionarily conserved, irrespective of male gametes being free swimming in extant early land plants or being delivered passively within a pollen tube in angiosperms, the moss *Physcomitrium* patens serves as our model to study the evolution of (epi)genetic mechanisms governing male gametogenesis.

/ HIGHLIGHTS IN 2020

The research team established AtNOT1, the scaffolding protein of the CCR4-NOT complex, as as an important player during gametophyte development in Arabidopsis thaliana. Their study revealed that NOT1 is necessary for cell-type- and stage-specific transitions during gametophyte development and early embryogenesis (Pereira et al., Plant Journal 2020). In addition, three collaborations have yielded the following results: (1) In collaboration with the Berger lab we have shown that targeted reprogramming of H3K27me3 resets epigenetic memory in Arabidopsis sperm cells, facilitating transcription of genes essential for spermatogenesis and pre-configuring sperm chromatin for gene expression in the next generation (Borg et al., Nature Cell Biology 2020), (2) The EVOREPRO database was published, and the analysis of this extensive RNA-Seq data set revealed conserved transcriptional programs underpinning organogenesis and reproduction in land plants (Julca et al., BioRxiv, https://doi.org/10.1101/2020.10.29.361501) and (3) researchers have characterized the bicentriole-mediated pathway for de novo centriole assembly during male gametogenesis in Physcomitrium patens, including its molecular conservation. (Gomes Pereira et al., BioRxiv, https://doi.org/10.1101/2020.12.21.423647).

LAB MEMBERS IN 2020

Rui Martinho, Visitor
Joana Martins Almeida, MSc
Clément Roumégoux, MSc
Miguel Sordo, MSc
Sónia Pereira (IBB 2017), PhD student
Chandra Shekhar Misra (Plants for Life (ITQB NOVA), PhD student
Carmen Santana (IBB 2018), PhD student
Parícia Pereira (FCUL), PhD student
Anton Kermanov (IBB 2017), PhD student
Armin Horn (Plants for Life (ITQB NOVA), PhD student
Mário Santos, PhD holder, Lab manager, Lab Manager

PUBLICATIONS

1. Pereira PA, Boavida LC, Santos MR & Becker JD*. AtNOT1 is required for gametophyte development in Arabidopsis. Plant Journal, 103: 1289–1303 (2020)

2. Borg M, Jacob Y, Suzaki D, LeBlanc C, Buendia D, Axelsson E, Kawashima T, Voigt P, Boavida L, Becker JD, Higashiyama T, Martienssen R & Berger F. Targeted reprogramming of H3K27me3 resets epigenetic memory in plant paternal chromatin. Nature Cell Biology, 22(6):621-629 (2020)

3. Navarro-Costa PA, Molaro A, Misra CS, Meiklejohn CD & Ellis, PJ. Sex and suicide: The curious case of Toll-like receptors. PLoS Biology, 18(3), e3000663. (2020)

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
Marie Curie

NEW GRANTS IN 2020

FCT Fundação para a Ciência e Tecnologia

/ COVID-19 HIGHLIGHTS

Several lab members helped running COVID tests in the first half of 2020.

STAFF INVOLVED IN COVID EFFORTS:

Involved in running COVID tests at IGC in first half of 2020: Sónia Pereira, Paulo Navarro-Costa & Anton Kermanov

GROUP NAME

CHROMOSOME DYNAMICS

RESEARCH GROUP LEADER

Raquel Oliveira

Research Interests: During cell division, the genetic information contained in the chromosomes needs to be equally distributed to the new cells that are formed. If the distribution of the genetic material is somehow impaired, cells may obtain an abnormal number of chromosomes or even break and loose significant parts of the genome. These abnormalities are usually associated with many health conditions, such as cancer development, genetic disorders and infertility. Raquel Oliveira´s lab investigates how chromosomes are assembled and how their morphology influences the fidelity of cell division.

/ HIGHLIGHTS IN 2020

The research team have recently obtained exciting preliminary results and optimized novel tools to study transcription dynamics during the cell cycle. This allowed them to broaden their research interests, aiming to uncover how transcription is shut-down upon mitotic entry. This new research line was awarded an ERC Consolidator grant – Chromosilence - in 2020. In a fruitful collaboration with the Jansen Lab (Oxford), the research team has also uncovered how the centromere, a chromosome region essencial for correct cell division, is smaller and weaker in stem cells, when compared to differentiated cells (Milagre et al, Open Biology 2020). These findings open new insights on why stem cells are more prone to chromosome segregation errors, one of the major limitations for their use in regenerative medicine.

LAB MEMBERS IN 2020

Salma Rahme, MSc
Catarina Carmo (IBB 2017), PhD Student
Margarida Araújo (IBB 2017), PhD Student
Carolina Pereira, PhD Student
João Coelho, Postdoc
Sara Carvalhal, Postdoc
Arunabha Bose, Postdoc
Inês Milagre, Postdoc
Alexandra Tavares, Lab Manager
Ana Boavida, Technician
Paola Gaetani, Technician

PUBLICATIONS

1. Milagre, I.; Pereira, C.; Oliveira, R.A. and Jansen, L.E.T. (2020) Reprogramming of human cells to pluripotency induces CENP-A chromatin depletion. Open Biology 10 200227 http://doi.org/10.1098/rsob.200227

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
ERC European Research Council Grant
Starting Grant - ChromoCellDev

NEW GRANTS IN 2020

ERC Consolidator Grant - ChromoSilence

/ COVID-19 HIGHLIGHTS

Staff members were involved in the COVID task force for testing: João Coelho, Margarida Araújo, Sara Carvalhal, Arunabha Bose and Carolina Pereira.

GROUP NAME

QUANTITATIVE ORGANISMAL BIOLOGY

RESEARCH GROUP LEADER

Jorge Carneiro

Research Interests: Mechanisms of biological individuation: How do cells organise into organisms. Stochastic processes as the source of organismal somatic variation.

LAB MEMBERS IN 2020

José Faro (University of Vigo), Visitor
Alberto Darszon (UNAM, Mexico), Visitor
Eleonora Tulumello (IBB 2015), PhD student

PUBLICATIONS

1. Ramos, C.V., L. Balesteros-Arias, J.G. Silva, J. Carneiro, E. Gjini, V.C. Martins. Cell competition, the kinetics of thymopoiesis, and thymus cellularity are regulated by double-negative 2 to 3 early thymocytes. Cell Reports. 32, 107910. (2020)

2. Guzella, T., V. Barreto, J. Carneiro. Partitioning stable and unstable expression level variation in cell populations: a theoretical framework and its application to the T cell receptor. PLoS Comput. Biol. 16, e1007910. (2020)

3. Priego-Espinosa, D., A. Darszon, A. Guerrero, A.L. Gonzalez-Cota, T. Nishigaki, Martinez-Mekler and J. Carneiro. Modular analysis of the control of flagellar Ca2+-spike trains produced by CatSper and CaV channels in sea urchin sperm. PLoS Comput. Biol. 16, e1007605. (2020)

/ COVID-19 HIGHLIGHTS

Editor of COLife COVID article digests, from April to July 2020 https://colife.eu/category/digest/; data analysis support to IGC teams involved in antibody tests; participated in the elaboration of COVID antibody triggers survey spearheaded by Carlos Penha Gonçalves; COLife Webinar on vaccines; https://www.spimunologia.org/news/international-day-of-immunology-colife-webinar-about-vaccines/

GROUP NAME

PLANT STRESS SIGNALLING

RESEARCH GROUP LEADER

Elena Baena Gonzalez

Research Interests: Plant carbon management; Mechanisms underlying carbon sensing and downstream signalling; Regulation of carbon signaling pathways by hormonal and other stress signals; Role of carbon signalling pathways on central metabolism; Role of carbon signaling pathways in stress responses and development.

/ HIGHLIGHTS IN 2020

The lab ream efforts thus far focus on one carbon signalling pathway mediated by the SnRK1/AMPK protein kinase. Researhers main findings this year have been: a) Besides regulating growth in response to energy signals, as in animals, the plant SnRK1-TOR module evolved to sense the phytohormone ABA. This innovation enabled plants to modulate growth also in response to water availability. b) The mode of regulation of the plant SnRK1/AMPK kinase is, contrary to its opisthokont counterparts, by release of repression rather than by direct activation, adding to the increasing list of plant signalling components that show this type of regulation. c) SnRK1 is part of the Suc-T6P system (analogous to the glucose-insulin system in mammals), required to maintain Suc homeostasis. SnRK1 influences the Suc-T6P relationship and modulates the flux of carbon to the TCA cycle (in preparation). d) Nuclear import through specific nuclear pore components is essential for the regulation of stress responses and growth by the plant SnRK1/AMPK kinase (in preparation).

LAB MEMBERS IN 2020

Bruno Peixoto (Plants for Life 2016), PhD Student
Filipa Lopes (Plants for Life 2017), PhD Student
Mónica Costa (Plants for Life 2018), PhD Student
Diana Reis (Plants for Life 2019), PhD Student
Ana Confraria, Postdoc
Leonor Margalha, Postdoc
Borja Belda-Palazón, Postdoc
Liliana Ferreira, Postdoc

PUBLICATIONS

1. Belda-Palazón B, Adamo M, Valerio C, Ferreira L, Confraria A, Reis-Barata D, Rodrigues A, Meyer C, Rodrigues PL and Baena-González E* (2020) A dual function of SnRK2 kinases in the regulation of SnRK1 and plant growth. Nature Plants 6, 1345-1353

2. Baena-González E* and Lunn JE* (2020) SnRK1 and trehalose 6-phosphate – two ancient pathways converge to regulate plant metabolism and growth. Curr Op Plant Biol. 55, 52-59

RUNNING GRANTS

LISBOA-01-0145-FEDER-028128,
Molecular mechanisms of energy management in plants;
PTDC/BIA-BID/32347/2017,
The role of energy signalling in shoot branching
(co-PI; PI: A. Confraria, IGC)

NEW GRANTS IN 2020

1) PTDC/BIA-FBT/4942/2020
2) FCT Fundação para a Ciência e Tecnologia

GROUP NAME

CELL BIOLOGY OF THE VIRAL INFECTION

RESEARCH GROUP LEADER

Maria João Amorim

Research Interests: The Maria João Amorim´s lab study host pathogen interactions and how viruses organize and utilize the cellular structure to replicate efficiently. Researchers hypothesise that liquid biomolecular condensates are global organizers of viral reactions, subjected to tight control, flexible and dynamic, and thus prone to antiviral targeting. Their model viruses are influenza A virus and SARS-CoV2.

/ HIGHLIGHTS IN 2020

Maria João Amorim strengthen her position in the virology field as a leader in phase separated organelles in virology; Attracted competitive funding - AS PI: ERC, CEEC, 1FCT grant; as collaborator - 2 FCT grants; 1 ANI grant. Contributed to IGC reputation of excellence in student training as director of the IGC summer school - this year a virtual meeting with 90 students; Increased visibility of the IGC through outreach activities; Explained the progression, developments and challenges of SARS-CoV2 pandemics to the public.

LAB MEMBERS IN 2020

Catarina Candeias (Intercafe 2019), Visitor
Diogo Athayde (Interface 2019), Visitor
Mariana Marques (Universidade de Aveiro), Visitor
(PhD students in collaboration with other labs)

Mónica Medina (António Coutinho Award 2020), MSc
Daniela Brás (Interface 2019), PhD
Nuno Santos (PGCD 2015), PhD
Temitope Etibor (IBB 2016), PhD
Christian Diwo (IBB 2019), PhD
Sílvia Vale-Costa, Postdoc
Filipe Ferreira, Postdoc
Marta Alenquer, Postdoc

PUBLICATIONS

1. Ho, J S Y, Angel, M, Ma, Y, Sloan, E, Wang, G, Martinez-Romero, C, Alenquer, M, Roudko, V, Chung, L, Zheng, S, Chang, M, Fstkchyan, Y, Clohisey, S, Dinan, A M, Gibbs, J, Gifford, R, Shen, R, Gu, Q, Irigoyen, N, Campisi, L, Huang, C, Zhao, N, Jones, J D, van Knippenberg, I, Zhu, Z, Moshkina, N, Meyer, L, Noel, J, Peralta, Z, Rezelj, V, Kaake, R, Rosenberg, B, Wang, B, Wei, J, Paessler, S, Wise, H M, Johnson, J, Vannini, A, Amorim, M J, Baillie, J K, Miraldi, E R, Benner, C, Brierley, I, Digard, P, Łuksza, M, Firth, A E, Krogan, N, Greenbaum, B D, MacLeod, M K, van Bakel, H, Garcia-Sastre, A, Yewdell, J W, Hutchinson, E, Marazzi, I, Hybrid Gene Origination Creates Human-Virus Chimeric Proteins during Infection, 2020, Cell, 181, 1502-1517. URL: https://doi.org/10.1016/j.cell.2020.05.035

RUNNING GRANTS

FCT RESEARCH4COVID 19
ANI under INOV4COVID

NEW GRANTS IN 2020

European Research Council Consolidator
FCT RESEARCH4COVID 19
ANI under INOV4COVID

EVENTS ORGANIZED

IGC Summer School - virtual hosted 90 participants

/ COVID-19 HIGHLIGHTS

Approval of saliva testing in Portugal for screening; Demonstration that saliva may be used for screening children in schools; Demonstration that SARS-CoV2 variants escape neutralizing immunity by natural infection and vaccination. Three articles of high impact.

COVID-19 COLLABORATIONS

Internal |
Ricardo Leite,
Jocelyne Demengeot,
Carlos Penha Gonçalves,
Isabel Gordo

External |
Vasco Barreto (CEDOC);
Helena Soares (CEDOC);
Celso Cunha (IHMT);
Cláudio Soares (ITQB),
Diana Lousa (ITQB);
Maria João Brito (Hospital Dona Estefânia);
José Alves (Hospital Amadora Sintra).

RESEARCH COVID-19

1) Saliva sampling for testing SARS-CoV2 - diagnostics;
2) Neutralization assays to quantify the neutralizing capacity of sera from naturally infected and vaccinated individuals.

STAFF INVOLVED:

Marta Alenquer; Sílvia Vale-Costa; Filipe Ferreira; Christian Diwo; Nuno Santos; Daniela Brás; Mónica Medina; Temitope Etibor

OUTCOMES

Approval of saliva testing in Portugal for screening; Demonstration that saliva may be used for screening children in schools; Demonstration that SARS-CoV2 variants escape neutralizing immunity by natural infection and vaccination. Three articles of high impact.

GROUP NAME

EVOLUTION AND DEVELOPMENT

RESEARCH GROUP LEADER

Élio Sucena

Research Interests: Evolution of the immune response in insects; The mechanistic basis of disease tolerance and resistance in Drosophila; The origins of transcriptional novelty.

/ HIGHLIGHTS IN 2020

Highlights in 2020: Researchers led by Élio have shown that ecdysone is involved in the regulation of AMP expression at pupariation. This expression does not depend on the presence and sensing of microbiota via conventional immune signalling pathways. In addition, they could establish that different AMPs have been co-opted to distinct tissues encompassing both systemic and local immune responses. In parallel, the research team found that individuals that do not produce AMPs exhibit higher bacterial proliferation during metamorphosis. Together, these observations support that AMP production is part of the metamorphosis developmental programme. Ultimately, the researchers aim at dissecting the gene regulatory network governing this mechanism at the onset of metamorphosis and test its correlation with the evolutionary emergence of holometaboly.

LAB MEMBERS IN 2020

David Duneau, Visitor
Diogo Roque, MSc
Catarina Nunes (IBB 2016), PhD Student
Tânia Paulo (IBB 2017), PhD Student
Priscilla Akyaw (IBB 2019), PhD Student

STAFF INVOLVED IN COVID EFFORTS:

Tânia Paulo and Catarina Nunes

PUBLICATIONS

1. M Kapun, MG Barrón, F Staubach, DJ Obbard, RAW Wiberg, J Vieira, C Goubert, O Rota-Stabelli, M Kankare, M Bogaerts-Márquez, A Haudry, L Waidele, I Kozeretska, EG Pasyukova, V Loeschcke, M Pascual, CP Vieira, S Serga, C Montchamp-Moreau, J Abbott, P Gibert, D Porcelli, N Posnien, A Sánchez-Gracia, S Grath, É Sucena, AO Bergland, MP Garcia Guerreiro, B Sebnem Onder, E Argyridou, L Guio, M Fristrup Schou, B Deplancke, C Vieira, MG Ritchie, BJ Zwaan, E Tauber, DJ Orengo, E Puerma, M Aguadé, P Schmidt, J Parsch, AJ Betancourt, T Flatt, J González (2020) Genomic analysis of European Drosophila populations reveals longitudinal structure and continent-wide selection. Molecular Biology and Evolution 37(9): 2661–2678.

2. Nunes C, Sucena É & Koyama T. (2020) Endocrine Regulation of Immunity in Insects, FEBS Journal.

ALLIANCES INVOLVED

DrosEU International Consortium

GROUP NAME

CELL BIOLOGY OF TISSUE MORPHOGENESIS

RESEARCH GROUP LEADER

Caren Norden

Research Interests: Morphogenesis, cells and developmental biology, zebrafish, organoids, retina, quantitative imaging.

/ HIGHLIGHTS IN 2020

Managed to move the rest of the lab from Dresden to Oeiras during pandemic. Published an e-Life paper and a review in Development, became EMBO member.

LAB MEMBERS IN 2020

Elisa Nerli, MSc
Jenny Kretzschmar, MSc
Louise Dagher, MSc
Mariana Maia Gil (IBB 2019), PhD Student
Lucrezia Camilla Ferme, PhD Student
Karen Grace Soans, PhD Student
Mauricio Rocha Martins, Postdoc
Ana Patricia Ramos, Postdoc
Tânia Ferreira, Lab manager

PUBLICATIONS

1. Nerli E., Rocha-Martins M., Norden C. (2020) Asymmetric neurogenic commitment of retinal progenitors involves Notch through the endocytic pathway, eLife. 2020, Nov 3. doi: 10.7554/eLife.60462.

2. Zechner C., Nerli E., Norden C. (2020) Stochasticity and determinism in cell fate decisions. Development 2020 147: dev181495 doi: 10.1242/dev.181495"

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
ERC European Research Council Grant
Consolidator Grant

PRIZES

Elected EMBO member

GROUP NAME

EVOLUTIONARY BIOLOGY

RESEARCH GROUP LEADER

Isabel Gordo

Research Interests: Study the process of adaptation in the context of ecosystems, specifically the mammalian intestine, in health and in disease conditions. Test theoretical models of adaptive evolution against genotypic and phenotypic data obtained in experimentally adapted bacterial populations.

/ HIGHLIGHTS IN 2020

6 publications from the lab.

LAB MEMBERS IN 2020

Scott Miller, Visitor
Luís Cardoso (IBB 2016), PhD Student
Hugo Barreto (IBB 2017), PhD Student
Massimo Amicone (IBB 2018), PhD Student
Francisco Paupério (IBB 2020), PhD Student
Nelson Frazão, Postdoc
Paulo Durão, Postdoc
Roberto Balbontín, Postdoc
Anke Konrad, Postdoc
Anastasia Kottara, Postdoc
Francisco Cerqueira, Postdoc
Daniela Güleresi, Lab Manager
Beatriz Abreu, Technician

PUBLICATIONS

1. Cardoso LL, Durão P, Amicone M, Gordo I (2020) Dysbiosis individualizes the fitness effect of antibiotic resistance in the mammalian gut. Nat Ecol Evol. https://doi.org/10.1038/s41559-020-1235-1

2. RS Ramiro, P Durão, C Bank, I Gordo (2020) Low mutational load and high mutation rate variation in gut commensal bacteria. PLoS biology 18 (3), e3000617, https://doi.org/10.1371/journal.pbio.3000617 Data and code for doi:10.1101/568709

3. HC Barreto, Sousa A and Gordo I (2020) The landscape of adaptive evolution of a gut commensal bacteria in aging mice. Current Biology. https://doi.org/10.1016/j.cub.2020.01.037

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
Nature Research;
German Research Foundation,
Marie Sklodowska-Curie COFUND

NEW GRANTS IN 2020

FCT Fundação para a Ciência e Tecnologia

/ COVID-19 HIGHLIGHTS

Experimental evolution of SARS-CoV-2 and Project COVID - Oral Vaccine

COVID-19 COLLABORATIONS

Internal
Luís Moita,
Maria João Amorim,
Jocelyne Demengeot,
Ricardo Leite;

External
João Paulo Gomes
Maria João Alves (INSA).

STAFF INVOLVED:

Hugo Barreto;
Massimo Amicone;
Nelson Frazão

RESEARCH COVID-19

COVID19_Research_evolution
(May 2020)

COVID_Oral Vaccine
(August 2020)

OUTCOMES

Measurement of the mutation rate of SARS-CoV-2, estimation of genetic constraints and adaptive mutation discovery. For the Vaccine Project- Pilot test completed, expecting the results of neutralizing capacity of the antibodies.

GROUP NAME

LYMPHOCYTE DEVELOPMENT AND LEUKEMOGENESIS

RESEARCH GROUP LEADER

Vera Martins

Research Interests:
1. Cell competition in the thymus;
2. Thymus Autonomy;
3. T cell acute lymphoblastic leukemia (T-ALL)

/ HIGHLIGHTS IN 2020

Scientific findings published:
1. Ramos et al, Cell Reports;
2. Alves et.al, EJI, Historical Article;
3. Graduation of M. Nogueira MSc (20/20)

LAB MEMBERS IN 2020

Marta Nogueira, MSc
Sara Azenha, MSc
Rafael Paiva, IBB 2016, PhD
Camila Ramos, IBB 2017, PhD
Ricardo Paiva, Postdoc

PUBLICATIONS

1. Ramos CV, Ballesteros-Arias L, Silva JG, Paiva RA, Nogueira MF, Carneiro J, Gjini E, Martins VC. 2020. Cell Competition, the Kinetics of Thymopoiesis, and Thymus Cellularity Are Regulated by Double-Negative 2 to 3 Early Thymocytes. Cell Rep 32: 107910 DOI: 10.1016/j.celrep.2020.107910;

2. NL Alves, Carvalho A, Serre K, Martins, VC, Saraiva, M. 2020. The Portuguese Society for Immunology (SPI): history and mission. Eur. J. Immunol. 7:918-920 DOI: 10.1002/eji.202070075

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia

/ COVID-19 HIGHLIGHTS

Vera coordinated, with the help of Inês Mesquita (ICVS), a short communication dedicated to the National effort on Covid, covering the role of the several Research Institutes in Portugal, on behalf of the Portuguese Society of Immunology (SPI) for the European Federation of Immunological Societies (EFIS) published on the Summer 2020 NewsFlash.

STAFF INVOLVED IN COVID-19 EFFORTS:

Rafael Paiva
Camila Ramos

GROUP NAME

PHYSICS OF INTRACELLULAR ORGANIZATION

RESEARCH GROUP LEADER

Ivo Telley

Research Interests: - The research group studies physical aspects of intracellular organization – the research team uses Drosophila melanogaster oogenesis and early embryogenesis as model systems. Researchers work on three research tracks: how minimal chemical and physical cues determine oocyte polarity; chemo-mechanical mechanisms leading to pronuclear fusion during fertilization; nuclear positioning during syncytial divisions in the embryo.

/ HIGHLIGHTS IN 2020

The research team concluded their work on the physics of nuclear positioning in the syncytial embryo and published a paper on bioRxiv while under review - They concluded a collaborative work on the spatial and temporal control of centriole de novo biogenesis in the syncytial embryo, and published a paper in bioRxiv while under review.

LAB MEMBERS IN 2020

Ana Milas, PhD IBB 2018, PhD
Margarida Araújo, PhD IBB 2017, PhD
Pedro Sampaio, external PhD student (CEDOC), PhD
Amid Massouh | Left in December, Postdoc
Jorge Carvalho | Left in November, Postdoc
Ojas Deshapnde | Left in June, Postdoc
Catarina Nabais | Left in October, Postdoc

PUBLICATIONS

1. Nabais C, Pessoa D, de-Carvalho J, van Zanten T, Duarte P, Mayor S, Carneiro J, Telley IA & Bettencourt-Dias M. Plk4 triggers autonomous de novo centriole biogenesis and maturation. Biorxiv (2020) doi:10.1101/2020.04.29.068650

2. de-Carvalho J, Tlili S, Hufnagel L, Saunders TE & Telley IA. Aster repulsion drives local ordering in an active system. Biorxiv (2020) doi:10.1101/2020.06.04.133579

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
HFSP Young Investigator Grant

NEW GRANTS IN 2020

FCT Fundação para a Ciência e Tecnologia

GROUP NAME

INNATE IMMUNITY AND INFLAMMATION

RESEARCH GROUP LEADER

Luís Moita

Research Interests: Innate Immunity

/ HIGHLIGHTS IN 2020

Published 8 original papers, clinical trial to test the effect of epirubicin in sepsis funded by the german Federal Government (€1.5M), Henrique Colaço successfully defended his thesis at IGC.

LAB MEMBERS IN 2020

Lindsay Kosack, MSc
André Barros, PhD
Katia Jesus, PhD
Tiago Velho, PhD
Isa dos Santos, PhD
Katharina Willmann, Postdoc
Ana Neves Costa, Postdoc
Dora Pedroso, Postdoc
Elsa Seixas, Postdoc

PUBLICATIONS

1. Ribosome-Targeting Antibiotics Impair T Cell Effector Function and Ameliorate Autoimmunity by Blocking Mitochondrial Protein Synthesis. Almeida L, Dhillon-LaBrooy A, Castro CN, Adossa N, Carriche GM, Guderian M, Lippens S, Dennerlein S, Hesse C, Lambrecht BN, Berod L, Schauser L, Blazar BR, Kalesse M, Müller R, Moita LF, Sparwasser T. Immunity. 2021 Jan 12;54(1):68-83.e6. doi: 10.1016/j.immuni.2020.11.001. Epub 2020 Nov 24.

2. Tetracycline Antibiotics Induce Host-Dependent Disease Tolerance to Infection. Colaço HG, Barros A, Neves-Costa A, Seixas E, Pedroso D, Velho T, Willmann KL, Faisca P, Grabmann G, Yi HS, Shong M, Benes V, Weis S, Köcher T, Moita LF. Immunity. 2021 Jan 12;54(1):53-67.e7. doi: 10.1016/j.immuni.2020.09.011. Epub 2020 Oct 14.

3. CXCL5-mediated recruitment of neutrophils into the peritoneal cavity of Gdf15-deficient mice protects against abdominal sepsis. Santos I, Colaço HG, Neves-Costa A, Seixas E, Velho TR, Pedroso D, Barros A, Martins R, Carvalho N, Payen D, Weis S, Yi HS, Shong M, Moita LF. Proc Natl Acad Sci U S A. 2020 Jun 2;117(22):12281-12287. doi: 10.1073/pnas.1918508117. Epub 2020 May 18.

RUNNING GRANTS

European Research Council

/ COVID-19 HIGHLIGHTS

a. Together with the M. Soares´ laboratory, working on a project to characterize the pathophysiology of COVID-19 in a mouse model of the disease.

b. Together with the M. Soares´ laboratory, working on a project to identify novel candidate treatment for COVID-19, using our previous discoveries in the pharmacological induction of disease tolerance to infection.

c. Together with I. Gordo´s laboratory, working on an innovative vaccine candidate against COVID-19.

STAFF INVOLVED:

Katia Jesus,
Lindsay Kosack

RESEARCH COVID-19

Characterization of COVID19 pathophysiology, development of pharmacological treatments, development of a vaccine.

OUTCOMES

Characterization of COVID19 pathophysiology, development of pharmacological treatments, development of a vaccine.

GROUP NAME

MATHEMATICAL MODELLING OF BIOLOGICAL PROCESSES

RESEARCH GROUP LEADER

Erida Gjini

Research Interests: The research group lead bt Erida studies host-pathogen interactions using mathematical frameworks for a deep mechanistic understanding. Their models seek to identify and quantify fundamental principles by which diversity affects health and disease in a range of microbial ecosystems. In two pioneering studies (*), researchers have discovered the link between colonization and co-colonization processes and evolutionary dynamics in interacting multispecies communities. Applications involve multi-strain infectious disease epidemiology, antibiotic resistance, microbiota colonization resistance, and the stress-gradient hypothesis.

/ HIGHLIGHTS IN 2020

After a 5-year cycle at IGC, this was the research group transition year from IGC to a new institution. The main achievement was to complete their most important publications and prepare the move to Instituto Superior Tecnico, at University of Lisbon. The 4th Master student graduated, and won a Phd scholarship in Utrecht, NL. The research group hosted 2 international visits at IGC in Feb. 2020, from France and USA. The lab published 3 papers, co-authored 2 more in collaboration within IGC, and had 2 more in review in Dec. 2020. The (Madec & Gjini, 2020) BMB paper was the most downloaded paper of the journal in November 2020, attracting genuine interest and high attention scores.

LAB MEMBERS IN 2020

Afonso Dimas Martins, MSc
completed his MSc thesis in January 2020
Ermanda Dekaj, MSc
won an FCT research fellowship in fall 2020 to work in the group

PUBLICATIONS

1. Madec S. and Gjini, E. (2020) Predicting N-strain coexistence from co-colonization interactions: epidemiology meets ecology and the replicator equation, Bulletin of Mathematical Biology 82, 142.
2. Gjini E., Pauperio F.F.S. and Ganusov V.V. (2020) Treatment timing shifts the benefits of short vs. long antibiotic treatment over infection, Evolution, Medicine, and Public Health, eoaa033
3. Dimas Martins A. and Gjini E. (2020) Modeling competitive mixtures with the Lotka-Volterra framework for more complex fitness assessment between strains, Frontiers in Microbiology | doi: 10.3389/fmicb.2020.572487

RUNNING GRANTS | 3

FLAD-NSF
FCT Fundação para a Ciência e Tecnologia

NEW GRANTS IN 2020

FCT Fundação para a Ciência e Tecnologia

/ COVID-19 HIGHLIGHTS

Modeling Covid dynamics and consulting for the Albanian Ministry of Health and Albanian Institute of Public Health; Gjini E. (2020) Modeling Covid-19 dynamics for real-time estimates and projections: an application to Albanian data (medRxiv preprint) https://doi.org/10.1101/2020.03.20.20038141.

GROUP NAME

EVOLUTIONARY DYNAMICS

RESEARCH GROUP LEADER

Claudia Bank

Research Interests: evolutionary theory; microbial evolution, adaptation; speciation; population genetics; mathematical modelling

/ HIGHLIGHTS IN 2020

In a collaboration with the Bettencourt-Dias lab, the research group developed a model to describe centriole number distributions in cancer cell populations under the influence of centriole overproduction and selection (Louro et al., Plos Comp Bio, in press). Moreover, analyzing the fitness effects of all possible single-codon mutations in a large stretch of the heat-shock protein Hsp90 in yeast, researchers discovered the locations of hotspots of beneficial and deleterious mutations, as well as environmentally sensitive regions of the protein (Cote-Hamarlof, Fragata et al., MBE, 2020).

LAB MEMBERS IN 2020

Marco António Dias Louro, PhD
Ana-Hermina Ghenu, PhD
Juan Li, Postdoc
Ana Yansi Morales Arce, Postdoc
Davide Cusseddu, Postdoc
André Amado, Postdoc
Lucy Lansch-Justen (Programmer), Other
Mark Schmitz (Data Manager), Other
Inês Borges (Bachelor Student), Other

PUBLICATIONS

1. M.A.D. Louro, Mónica Bettencourt-Dias, and C. Bank. Patterns of selection against centrosome amplification in human cell lines. bioRxiv, doi: 10.1101/2020.01.24.918615 (Plos Computational Biology, in revision)

2. E. Berdan*, A. Blanckaert*, R.K. Butlin, and C. Bank. Deleterious mutation accumulation and the long-term fate of chromosomal inversions. biorxiv, doi: 10.1101/606012 (Plos Genetics, pending minor revision)

3. P.A. Cote-Hammarlof*, I. Fragata*, J.M. Flynn, K.B. Zeldovich, C. Bank#, and D.N.A. Bolon#. The Adaptive Potential of the Middle Domain of Yeast Hsp90. Molecular Biology and Evolution, doi: 10.1093/molbev/msaa211.

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
ERC European Research Council Grant
EMBO Installation Grant

NEW GRANTS IN 2020

HFSP Young Investigator Grant

GROUP NAME

MEMBRANE TRAFFIC

RESEARCH GROUP LEADER

Colin Adrain

Research Interests: The Adrain lab is interested in defining the pathophysiological roles of 'proteostasis' (protein homeostasis) in the secretory pathway. In particular, we want to understand how membrane protein biogenesis, trafficking, degradation or proteolysis controls organismal metabolic homeostasis, during health and disease.

/ HIGHLIGHTS IN 2020

1 - CA edited a Special Issue on Pseudoenzymes in The FEBS Journal.;

2 - Researchers continued their studies on the role of the iRhom/ADAM17 "sheddase complex", identifying a novel role for ADAM17 within adipose tissue in metabolic homeostasis.

3 - Researchers identified a novel role for a membrane protein biogenesis machinery called the EMC (ER membrane complex) in metabolic regulation in vivo.

LAB MEMBERS IN 2020

Abdulbasit Amin, PhD Student, IBB, PhD
Christian Diwo, PhD Student, IBB 2019, PhD
Catarina Gaspar, External PhD student, PhD
Érika de Carvalho, External PhD student, PhD
Marina Badenes, Postdoc
Miguel Cavadas, Postdoc

STAFF INVOLVED IN COVID19 EFFORTS

Christian Diwo, Serology
Érika de Carvalho, Serology

PUBLICATIONS

1. Adrain*, C. (2020) Guest Editor, Special Issue on Pseudoenzymes, The FEBS Journal. In press, October 2020.

2. Adrain*, C. & Cavadas, M* (2020). The complex life of rhomboid pseudoproteases. The FEBS Journal. In press, doi: 10.1111/febs.15548.

3. Badenes, M., Amin, A., González-García, I., Félix, I., Burbridge, E., Cavadas, M., Ortega, F.J., de Carvalho, É., Faísca, P., Carobbio, S., Seixas, E., Pedroso, D., Neves-Costa, A., Moita, L.F., Fernández-Real, J.M.,Vidal-Puig, A., Domingos, A., López, M. and Adrain*, C (2020). Deletion of iRhom2 protects against diet-induced obesity by increasing thermogenesis. Mol Metab, 31, 67-84.

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
Fundació La Caixa Health Research

GROUP NAME

CELL CYCLE REGULATION

RESEARCH GROUP LEADER

Monica Dias

Research Interests: General principles in biology: counting and assembling of complex subcellular structures and their variations during development, disease and evolution. The research team use centrioles and cilia as our study subjects: mechanisms of biogenesis, maintenance & function, disease (cancer) and evolution.

/ HIGHLIGHTS IN 2020

Monica´s group submitted important work as five preprints on centriole biogenesis and cilia maintenance. Those preprints, including in collaboration with colleagues Ivo Telley, Jorg Becker and Jorge Carneiro highlighted that centriole de novo biogenesis relies on the pericentriolar matrix and that it is very conserved throughout evolution, including in plants. Moreover, we made important computational models related to how centriole number is controlled in normal cells and cancer with colleagues Claudia Bank and Jorge Carneiro. Finally, we investigated ciliary maintenance and found that intraflagellar transport is very important in cilia homeostasis.

Our collaboration with other groups gave rise to two publications: Gurkaslar HK, Culfa E, Arslanhan MD, Lince-Faria M, Firat-Karalar EN (2020) CCDC57 Cooperates with Microtubules and Microcephaly Protein CEP63 and Regulates Centriole Duplication and Mitotic Progression. Cell Rep. 2020 May 12;31(6):107630 and Di Nardo A, Lenoël I, Winden KD, Rühmkorf A, Modi ME, Barrett L, Ercan-Herbst E, Venugopal P, Behne R, Lopes CAM, Kleiman RJ, Bettencourt-Dias M, Sahin M (2020) Phenotypic Screen with TSC-Deficient Neurons Reveals Heat-Shock Machinery as a Druggable Pathway for mTORC1 and Reduced Cilia. Cell Rep. 2020 Jun 23;31(12):107780.

Four of our postdocs were offered positions in other Universities / Institutes in Portugal and abroad.

LAB MEMBERS IN 2020

Catarina Peneda (GABBA 2016),
PhD Student
Irina Fonseca,
PhD Student
Marco Louro (2017 IBB),
PhD Student
Sonia Pereira (2016 IBB),
PhD Student
Ana Rita Marques,
PostDoc
Catarina Nabais,
PostDoc
Carla Lopes,
PostDoc

Mafalda Pimentel,
PostDoc

Nuria Marin,
PostDoc

Pilar Ramos,
PostDoc

Swadhin Jana,
PostDoc

Tânia Perestrelo,
PostDoc

Paulo Duarte
Research Technician

Mariana Lince-Faria
Lab Manager

STAFF INVOLVED IN COVID19 EFFORTS

Tânia Perestrelo,
Catarina Peneda,
Carla Lopes,
Mariana Faria,
Nuria Marin,
Sonia Pereira,
Paulo Duarte.

PUBLICATIONS

1. Gurkaslar HK, Culfa E, Arslanhan MD, Lince-Faria M, Firat-Karalar EN (2020) CCDC57 Cooperates with Microtubules and Microcephaly Protein CEP63 and Regulates Centriole Duplication and Mitotic Progression. Cell Rep. 2020 May 12;31(6):107630.

2. Nabais C, Peneda C, Bettencourt-Dias M. (2020) Evolution of centriole assembly. Curr Biol. 2020 May 18;30(10): R494-R502. (Review)

3. Di Nardo A, Lenoël I, Winden KD, Rühmkorf A, Modi ME, Barrett L, Ercan-Herbst E, Venugopal P, Behne R, Lopes CAM, Kleiman RJ, Bettencourt-Dias M, Sahin M (2020) Phenotypic Screen with TSC-Deficient Neurons Reveals Heat-Shock Machinery as a Druggable Pathway for mTORC1 and Reduced Cilia.Cell Rep. 2020 Jun 23;31(12):107780.

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
ERC European Research Council Grant

NEW GRANTS IN 2020

European Proteomics Infrastructure Consortium

GROUP NAME

HOST-PATHOGEN CO-EVOLUTION

RESEARCH GROUP LEADER

Jonathan Howard

Research Interests: Toxoplasma, Mouse, Co-Evolution. The research group work, led by Jonathan Howard, focuses on mechanisms of resistance to the ubiquitous intracellular protozoan parasite, Toxoplasma gondii, a malaria relative, which infects about 40% of the human race.

They 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 2020

Ana Lina Pereira Rodrigues, PhD

Martha Catalina Alvares Meneses, PhD

Ana Claudia da Silva Campos,
Lab Manager/Research Assistant

STAFF INVOLVED IN COVID19 EFFORTS

Claudia Campos was part of the Team of voluntaries for Covid19 diagnostics at IGC

PUBLICATIONS

1. Eren E, Planès R, Bagayoko S, Bordignon PJ, Chaoui K, Hessel A, Santoni K, Pinilla M, Lagrange B, Burlet-Schiltz O, Howard JC, Henry T, Yamamoto M, Meunier E. Irgm2 and Gate-16 cooperatively dampen Gram-negative bacteria-induced caspase-11 response. EMBO Rep. 2020 Nov 5;21(11):e50829. doi: 10.15252/embr.202050829. Epub 2020 Oct 30. PMID: 33124769; PMCID: PMC7645206.

GROUP NAME

POPULATION AND CONSERVATION GENETICS (PCG)

RESEARCH GROUP LEADER

Lounès Chikhi

Research Interests: The PCG is interested in genetic and genomic diversity. More specifically we try to understand how the patterns of genetic diversity and differentiation observed today have been influenced by the recent evolutionary history of species. The patterns we observe today are 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, without mentioning selection acting in complex ways across populations and genomic regions.

To study these patterns, and the underlying processes, we develop research projects that bring together theoreticians and ecologists. We use/test existing statistical methods to improve our understanding of the recent evolutionary history of species. We try and develop new approaches as well. We also, and crucially, want to understand the limits of genetic or genomic data as inferential tools. The group is interested in applying this research to questions related to human evolutionary history (e.g. the Neolithic transition in Europe, or ancient structure in human populations, including interactions, or lack thereof, with Neanderthals and Denisovans) to conservation genetics of wild (e.g. orang-utans, lemurs, rodents; African primates; or dolphins) and domesticated species (e.g. cattle, sheep).

Our work involves fieldwork in Madagascar, Borneo, West Africa and Portugal, and the genetic and genomic typing of endangered species, data analysis and simulation.

/ HIGHLIGHTS IN 2020

Description of a new mouse lemur species (Microcebus jonahi) + Genetic analysis of social structure in endangered lemur Propithecus tattersalli + Range of endangered Phaner electromontis. The PCG has been working in Madagascar for more than ten years. Years of field work and international collaborations have given us the opportunity to study highly endangered Malagasy species, mainly lemurs, in different regions of the island. In the last few years, we collaborated in an international study on mouse lemurs (genus Microcebus) identified in eastern Madagascar. By using genomic and morphological data it was found that the analysed specimens were different from neighbouring mouse lemurs. We applied a series of criteria to several pairs of previously recognized mouse lemur species and found that the newly identified individuals were more divergent from neighbouring species than some of these species between them. The result of this study led us to conclude that we had likely identified a new mouse lemur species, which we named M. jonahi in honour of Malagasy conservationist Jonah Ratsimbazafy. We also noted that a previously identified pair of neighbouring species did not pass the criteria and might actually be divergent populations from the same species.

In addition, we studied the genotypic and genetic diversity of an endangered lemur from northern Madagascar (Propithecus tattersalli), and clarified the range and conservation status of an endangered and elusive lemur (Phaner electromontis), demonstrating its presence in forests where its presence was previously unknown.

LAB MEMBERS IN 2020

Maria Margarida Henrique Cardoso, MSc
NOS Alive Oeiras - IGC fellow 2020

Hugo Lainé, MSc
Research Technician Computation Biology

Gabriele Sgarlata - IBB 2016, PhD

Bárbara Parreira, Postdoc

Inês Carvalho, Postdoc

Tânia Minhós, Postdoc

Rémi Tournebize, Postdoc

Filipa Borges, Lab Manager

PUBLICATIONS

1. Hending, D, Sgarlata, GM, Le Pors, B, Rasolondraibe, E, Jan, F, Rakotonanahary, AN, Ralantoharijaona, TN, Debulois, S, Andriaiaina, A, Cotton, S, Rasoloharijaona, S, Zaonarivelo, JR, Andriaholinirina, NV, Chikhi, L, Salmona, J, 2020. Distribution and conservation status of the endangered Montagne d'Ambre forkmarked lemur (Phaner electromontis). Journal of Mammalogy 101: 1049-1060.

2. Parreira B., Quéméré E., Carvalho I., Vanpé C. & Chikhi L. 2020. Genetic consequences of social structure in the golden-crowned sifaka. Heredity 125: 328-339.

3. Schüßler D, Blanco MB, Salmona J, Poelstra J, Andriambeloson JB, Miller A, Randrianambinina B, Rasolofoson DW, Mantilla-Contreras J, Chikhi L, Louis Jr EE, Yoder AD, Radespiel U (2020) Ecology and morphology of mouse lemurs (Microcebus spp.) in a hotspot of microendemism in northeastern Madagascar, with the description of a new species. American Journal of Primatology, 82:e23180. https://onlinelibrary.wiley.com/doi/full/10.1002/ajp.23180

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
Fundo Azul
ERA-NET COFUND

GROUP NAME

HOST MICROORGANISMS INTERACTIONS

RESEARCH GROUP LEADER

Luís Teixeira

Research interesest: Wolbachia titres regulation. Wolbachia antiviral protection. Drosophila gut microbiota. Antiviral immunity.

/ HIGHLIGHTS IN 2020

Received Twinning Grant from EU H2020 952537, SymbNET - Genomics and Metabolomics in a Host-Microbe Symbiosis Network. Luis Teixiera, research group leader, was elected EMBO member.

LAB MEMBERS IN 2020

Steve Perlman (Univ. Victoria, Canada), Visitor
Ana Carvalho, MSc
Gonçalo Matos PhD
Miguel Landum PhD
Catarina Carmo, Postdoc
Sergio López-Madrigal, Postdoc
Nelson Martins, Postdoc
Migla Miskinyte, Postdoc
Teresa Maia, Research Technician
Rafael Caetano, Research Technician
Pedro Marinho, Research Technician
Beatriz Reis, Research Technician
Rita Valente, Lab manager

PUBLICATIONS

1. Duarte, E. H., Carvalho, A., López-Madrigal, S., Costa, J., Teixeira, L. 2020. Forward genetics in Wolbachia: Regulation of Wolbachia proliferation by the amplification and deletion of an addictive genomic island. bioRxiv. 11, 2020.09.08.288217

2. Chrostek, E., N. Martins, E., Marialva, M. S., Teixeira, L. 2020. Wolbachia-conferred antiviral protection is determined by developmental temperature. bioRxiv, 2020.06.24.169169

3. Vieira, F. J. D., Nadal-Jimenez, P, Teixeira, L. Xavier, K. 2020. Erwinia carotovora Quorum Sensing System Regulates Host-Specific Virulence Factors and Development Delay in Drosophila melanogaster. MBio. 11, 169 (2020).

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
ERC European Research Council Grant

NEW GRANTS IN 2020

Twinning Grant from EU H2020 (952537)
Project Coordinator.

GROUP NAME

COMPLEX ADAPTIVE SYSTEMS AND COMPUTATIONAL BIOLOGY

RESEARCH GROUP LEADER

Luís Rocha

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 redundancy, robustness, modularity and control in complex biochemical networks, collective intelligence on the web and in social systems, and agent-based models of evolutionary systems. We are also committed to interdisciplinary research, teaching and graduate training. Also, during the pandemic, the PI presented a complex systems perspective of the ongoing pandemic to the general public by publishing several opinion articles in leading Portuguese newspapers.

/ HIGHLIGHTS IN 2020

Publication in high-impact publications (such as PNAS) of research threads matured in the group over several years. Furthermore, the PI accepted a named professorship at the State University of New York in recognition of important work in complex systems and artificial intelligence.

LAB MEMBERS IN 2020

Andrea Sofia Teixeira, Phd Student
Rion Brattig Correia, Postdoc

PUBLICATIONS

1. R.B. Correia, I.B Wood, J. Bollen, L.M. Rocha [2020]. "Mining social media data for biomedical signals and health-related behavior". Annual Review of Biomedical Data Science . 3(1): 433-458. DOI: 10.1146/annurev-biodatasci-030320-040844.

2. Cherifi, H., Rocha, L.M., and Wasserman, S. [2020]. "Introduction to the special issue on COMPLEX NETWORKS 2018". Network Science . 8(S1-S3). DOI: 10.1017/nws.2020.22.

3. Cherifi, C., Gaito, S., Mendes, J.M., Moro E., Rocha, L.M. (Eds.) [2020]. Complex Networks and Their Applications VIII:. Proceedings The 8th International Conference on Complex Networks and Their Applications COMPLEX NETWORKS 2019. Studies in Computational Intelligence Series. Vol. 881-882. Springer. DOI: 10.1007/978-3-030-36687-2 and 10.1007/978-3-030-36683-4. (Two Volumes)

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
National Institutes of Health, National Library of Medicine Program
National Science Foundation, Research Traineeship (NRT) Program

GROUP NAME

INFLAMMATION LABORATORY

RESEARCH GROUP LEADER

Miguel Soares

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.

/ HIGHLIGHTS IN 2020

The research group findings suggest that the positive selection of GGTA1 loss-of-function mutations in the common ancestor of Old World primates was propelled by an overall enhancement in IgG effector function, providing resistance against infection by gut bacteria pathobionts that would otherwise lead to the development of sepsis. This provided a survival advantage against infection by a broad range of pathogens, likely outweighing the trade-off imposed by the emergence of reproductive senescence and lower reproductive output, potentially explaining why loss of GGTA1 was a rare event, which occurred almost exclusively in Old World primates, including humans. (bioRxiv 2020.07.10.186742). The research group contributed to the finding by the laboratory of Luis Ferreira Moita, which identified and characterized a novel effect of Anthracyclines that contributes to the reduction of inflammation and is independent of the activation of DNA damage responses. These findings may be relevant for the development of novel strategies targeting immune-mediated inflammatory diseases. (bioRxiv 2020.04.27.065003). The research team contributed to the finding by the laboratory of Shaden Kamhawi's Lab, which identified and characterized how HO-1 induction through erythrophagocytosis is a universal mechanism that regulates skin inflammation following blood feeding by arthropods, thus promoting early-stage disease tolerance to vector-borne pathogens. (Cell Rep. 2020 Oct 27;33(4):108317).

In collaboration with Alain Le Moine and Stanislas Goriely the Soares´s lab unveiled that HO-1 expression in tumor-infiltrating monocytic cells represents a molecular switch that promotes their immunosuppressive functions. (JCI Insight. 2020 Jun 4;5(11):e133929). With Ari Waisman Laboratory, the research team identified a functional crosstalk of Blood Brain Barrier endothelial cells IL-1 signaling and HO-1, controlling the transcription of downstream proinflammatory genes and thus promoting the pathogenesis of autoimmune neuroinflammation. (Acta Neuropathol. 2020 Oct;140(4):549-567). With Maziar Divangahi´s Lab, researchers led by Miguel Soares demonstrated that M. tuberculosis reprograms Hematopoietic Stem Cells via an IFN-I response that suppresses myelopoiesis and impairs development of protective trained immunity to Mtb. (Cell. 2020 Oct 29;183(3):752-770.e22).

LAB MEMBERS IN 2020

Gil Pires, MSc
Vital Domingues IBB2015, PhD student
Temitope Wilson Ademolue IBB2018, PhD student
Susana Ramos, Postdoc
Jessica Thompson, Postdoc
Rui Martins, Postdoc
Qian Wu, Postdoc
Elisa Jentho, Postdoc
Sumnima Singh, Postdoc
Sílvia Cardoso, Research Technician
Sofia Rebelo, Lab manager

PUBLICATIONS

1. DNA damage independent inhibition of NF-κB transcription by anthracyclines, Angelo Chora, Dora Pedroso, Nadja Pejanovic, Eleni Kyriakou, Henrique Colaço, Raffaella Gozzelino, André Barros, Katharina Willmann, Tiago Velho, Catarina F. Moita, Isa Santos, Pedro Pereira, Sílvia Carvalho, Filipa Martins, João A. Ferreira, Sérgio Fernandes de Almeida, Vladimir Benes, Josef Anrather, Miguel P. Soares, Arie Geerlof, Jacques Neefjes, Michael Sattler, Ana C. Messias, Ana Neves-Costa, Luís Ferreira Moita bioRxiv 2020.04.27.065003; doi: https://doi.org/10.1101/2020.04.27.065003

2. A trade-off between resistance to infection and reproduction in primate evolution, Sumnima Singh, Jessica A. Thompson, Sebastian Weis, Daniel Sobral, Mauro Truglio, Bahtiyar Yilmaz, Sofia Rebelo, Silvia Cardoso, Erida Gjini, Gabriel Nuñez, Miguel P. Soares bioRxiv 2020.07.10.186742; doi: https://doi.org/10.1101/2020.07.10.186742. Published in Cell Host & Microbe

3. M. tuberculosis Reprograms Hematopoietic Stem Cells to Limit Myelopoiesis and Impair Trained Immunity , Khan N, Downey J, Sanz J, Kaufmann E, Blankenhaus B, Pacis A, Pernet E, Ahmed E, Cardoso S, Nijnik A, Mazer B, Sassetti C, Behr MA, Soares MP, Barreiro LB, Divangahi M. Cell. 2020 Oct 29;183(3):752-770.e22. doi: 10.1016/j.cell.2020.09.062

RUNNING GRANTS

FCT Fundação para a Ciência e a Tecnologia
European Commission - Marie Skłodowska-Curie Actions
la Caixa Foundation

NEW GRANTS IN 2020

FCT Fundação para a Ciência e a Tecnologia
European Commission - Marie Skłodowska-Curie Actions

COVID-19 RESEARCH:

Disease tolerance to COVID-19
(Pending BSL3 facility Instalation/Approval)

GROUP NAME

MECHANISMS OF MORPHOGENESIS

RESEARCH GROUP LEADER

Elias Barriga

Research interests: The research group studies the cellular, molecular, and biophysical mechanisms underlying collective cell migration (CCM) in embryogenesis and regeneration.

/ HIGHLIGHTS IN 2020

The research group published 5 papers. The research group leader obtained 3 Grants as principal investigator: ERC Starting grant (1.8 Million EUR), La Caixa Junior Leader (300K EUR) and a EMBO Installation Grant (150K EUR). Furthermore, Elias Barriga, principal investigator, also obtained a Grant as collaborator from the BBSRC grant United Kingdom with Prof Guillaume Charras. Two members of the team obtained Fellowships: Sofia Moreira, an FCT contract for 6 years and Fernando Ferreira, an EMBO long term fellowship.

LAB MEMBERS IN 2020

Ines Ferreira, MSc Student
Joana Saraiva, IBB PhD 2019, PhD Student
Sofia Moreira, Postdoc
Jaime Espina, Postdoc
Fernando Ferreira, Postdoc
Cristian Marchant, Postdoc
Joao Mata, Lab manager

NEW GRANTS

ERC European Research Council Grant
La Caixa Junior Leader
EMBO Installation Grant

PUBLICATIONS

1. Durotaxis: the mechanical control of directed cell migration. FEBS Journal; DOI: 10.1111/febs.15862.

2. The basics of collective cell migration: unity makes strength. In book: Viscoelasticity and Collective Cell Migration. DOI: 10.1016/B978-0-12-820310-1.00001-X.

3. Fine-tuning viscoelasticity: the key to collectively move in vivo. In book: Viscoelasticity and Collective Cell Migration. DOI:10.1016/B978-0-12-820310-1.00003-3.

COVID EFFORTS

The research group lab manager Joao Mata and the student Joana Saraiva helped at the beginning of the Covid testing initiative.

GROUP NAME

DISEASE GENETICS

RESEARCH GROUP LEADER

Carlos Penha-Gonçalves

Research Interests: Disease and organ dysfunction are in many cases controlled by genetic factors. Researchers from the lab are interested in uncovering how these factors work in specific cell types to drive organ inflammation trajectories and infectious disease outcomes. Under this theme they developed distinct projects working out protective roles of trophoblast cells in placental malaria, the action of brain endothelial cells in propagating inflammation in cerebral malaria and Kupffer cells responses to liver damage. To perform this research researchers have make use of multiple resources including human sample collections, mouse models of disease and optimized cell primary culture systems. This work is leading to ask how cell-type specific phenotypic adaptation triggered by inflammatory and infectious environments impacts in organ and systemic responses to subsequent challenges. The research team expect this research will contribute to bridge the fields of infectious diseases and metabolic disorders elucidating the role of disease adaptation mechanisms in the protection of organic and systemic functions.

/ HIGHLIGHTS IN 2020

The triggering receptor expressed on myeloid cells 2 (Trem-2) is an orphan immune receptor highly expressed in a particular liver macrophage population in phenotypic transition to the mature macrophages that replenish the liver after severe injury. The lab work revealed that Trem-2 is an unsuspected operator of a macrophage-endothelial cell crosstalk crucial in mounting swift regenerative reactions to hepatic tissue damage and liver fibrosis. Researchers from the lab propose that Trem-2 promotes the transition from pro-infammatory to tissue repair phase by driving the acquisition of restorative properties in phagocytic macrophages.

Brain microvessels endothelial cells (BMECs) compose the first layer of the blood brain barrier (BBB). BMECs are seen in cerebral malaria (CM) pathogenesis only as targets of pro-inflammatory mediators and circulatory/coagulation imbalances. Researchers from Disease genetics lab proposed that BMECs also take part in CM development as sensors and initiators of effector immune reactions elicited by Plasmodium components or infected erythrocytes (IE). We have shown that signaling through the IFN receptor (IFNAR1) in CD8T cells is required for development of murine experimental CM (ECM). Cytolytic CD8T cells play an effector role in ECM through killing endothelial cells upon cross-presenting specific PbA 3 peptides. However, the molecular mechanisms by which malaria infection leads to IFN-αβ-dependent activation of cytolytic CD8T cells in the brain microvasculature are still unknown. Researchers are currently addressing two questions that remain outstanding: How malaria infection induces brain microvasculature endothelial cells (BMECs) to produce IFN-αβ; What molecular signals delivered by BMECs are involved in IFNAR1-dependent activation of cytolytic CD8T cells.

In addition, the metabolism of endothelial cells may play a role in regulating antigen presentation and BBB integrity. Researchers are exploiting the hypothesis that Type I interferon signaling affects metabolic rewiring of the cells through regulation of Hypoxia-inducible factor 1-alpha (Hif1a), a master transcriptional regulator of cellular and developmental response to hypoxia implicated in vascularization and angiogenesis, regulation of energy metabolism and cell survival.

LAB MEMBERS IN 2020

Carolina Piedade (Jan 2020- Dec2020), MSc
Abdul Shafi, PhD student
Maria Teresa Pais, Postdoc
Inês Couto Coelho, Postdoc
Nádia Duarte, Lab Manager

PUBLICATIONS

1. TLR4-endothelin axis controls syncytiotrophoblast motility and confers fetal protection in placental malaria Yash Pandya, Alexander Marta, André Barateiro, Carla Letícia Bandeira, Jamille Gregório Dombrowski, João Costa, Cláudio Romero Farias Marinho and Carlos Penha-Gonçalves (Infection and Immnuity, in press).

2. Trem-2 Promotes Emergence of Restorative Macrophages and Endothelial Cells During Recovery From Hepatic Tissue Damage. Coelho I, Duarte N, Barros A, Macedo MP, Penha-Gonçalves C.Front Immunol. 2021 Feb 8;11:616044. doi: 10.3389/fimmu.2020.616044. eCollection 2020.PMID: 33628208

3. Production of high-quality SARS-CoV-2 antigens: Impact of bioprocess and storage on glycosylation, biophysical attributes, and ELISA serologic tests performance. Castro R, Nobre LS, Eleutério RP, Thomaz M, Pires A, Monteiro SM, Mendes S, Gomes RA, Clemente JJ, Sousa MFQ, Pinto F, Silva AC, Freitas MC, Lemos AR, Akpogheneta O, Kosack L, Bergman ML, Duarte N, Matoso P, Costa J, Bandeiras TM, Gomes-Alves P, Gonçalves CP, Demengeot J, Alves PM.Biotechnol Bioeng. 2021 Feb 24:10.1002/bit.27725. doi: 10.1002/bit.27725. Online ahead ofprint. PMID: 33624859

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
Network/Alliances | COVID-19 Host Genetics Initiative

/ COVID-19 HIGHLIGHTS

The unexpected COVID-19 pandemic outburst early on March 2020 lead to a concerted effort from the research community aiming at support the health and hospital services and to develop accessible diagnostic tests and tools to evaluate the development of anti-SARS-CoV-2 immunity following infection.

Researchers were very much involved in these COVID-19 oriented actions and in close collaboration with Jocelyne Demengeot have established several collaborations with national hospitals and city councils (Almeirim and Oeiras) to bridge our scientific knowledge with the needs of the healthcare workers in the field and the community most prevalent questions to better tackle this COVID-19 crisis. Researchers from the lab have been involved in proposals to conduct serological studies to monitor the pandemics in the country. In that context, in a collective effort at IGC together with other institutions researchers performed serological surveys in hospitals and communities, to ascertain the level and progression of anti-SARS-COV2 antibody prevalence. Taking advantage of the anti-spike ELISA assay they have developed in the context of a national consortium "Serology 4 COVID" they started a number of studies on vaccine effectiveness. The lab staff quantified the humoral immune response to the 1st and the 2nd dose of BNT162b2 mRNA COVID-19 (Pfizer/BioNTech, Comirnaty) in 1245 health care providers and 146 nursing home residents, together covering adult ages from 19 to 99 year. They observed inter-individual variation in the amplitude of the antibody response 3 weeks after administration of the 1st dose of the BNT162b2 pfizer vaccine, that were negatively associated with age. After the 2nd vaccinal dose robust IgG responses were achieved also in older individuals.

STAFF INVOLVED:

Nádia Duarte

RESEARCH COVID-19

Researchers put in place field studies to estimate the anti-SARS-CoV-2 seroprevalence in communities and in health workers. They are following the immune responses (antibodies) in vaccinated specific groups including hospital health workers and elderly in nursing homes. Researchers from the lab collect COVID19 patients samples aiming to identify host genetic factors that influence susceptibility to severe COVID-19 manifestations and to characterize the overwhellming inflammatory responses underlying severe and fatal COVID19.

OUTCOMES

Institutional protocols of scientific collaboration were established with a number of hospitals (public and private) in area of COVID19 research but also covering other possible research areas. Collaborations with IBET and technology transfer agreement with Medinfar are leading to the production of an ELISA-based commercial assay for detection anti-spike SARS-COV-2 antibodies.

GROUP NAME

INTEGRATIVE BEHAVIORAL BIOLOGY

RESEARCH GROUP LEADER

Rui Oliveira

Research interests:
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.

/ HIGHLIGHTS IN 2020

In 2020 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 behavior. Main findings this last year include: (1) demonstrating an evolutionary conserved role of oxytocin in emotion recognition; (2) showing a G x E interaction in the role of oxytocin on the development of social behavior in zebrafish; (3) identifying the perceptual mechanisms of social affiliation in zebrafish. During this year 2 new FCT grants were funded, 8 papers were published in peer-reviewed journals, 1 MSc and 1 PhD theses were completed.

In 2020 Rui Oliveira participated on the Music & Science Cycle, "The Biology of affect" Rui Oliveira talk at Mussorgsky, "Pictures at an exhibition" concert, Gulbenkian Foundation, March 3, 2020. Also this year Fronteiras XXI, "Do que é capaz o Cérebro?", Rui Oliveira participated as commentator, RTP3, September 23, 2020.

LAB MEMBERS IN 2020

Bianca Fusani (Trieste), MSc
Gessica Peres (ISPA, Lisbon), MSc
Thais Reis (ISPA, Lisbon), MSc
Gonçalo Melo (ISPA, Lisbon), MSc
Ibukun Akinrinade (PhD IBB 2015), PhD
Claudia Gonçalves (PGCD 2016), PhD
Carla Henriques (PhD IBB 2017), PhD
Felipe Espigares, Postdoc
Magda Teles, Postdoc
Ana Rita Nunes, Postdoc
Susana Varela, Postdoc
Victoria Alvarez, Postdoc
Kyriakos Kareklas, Postdoc
Fred Mery (sabbatical visitor; CNRS, Gif-sur-Yvette), Visitor

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
ISPA

NEW GRANTS IN 2020

FCT Fundação para a Ciência e Tecnologia

PUBLICATIONS

1. Triki Z., Emery Y., Teles M. C., Oliveira R.F., Bshary R. 2020. Brain morphology predicts social intelligence in wild cleaner fish. Nature communications, 11: 6423.

2. Ribeiro D., Nunes A.R., Teles M.C., Anbalagan S., Blechman J., Levkowitz G., Oliveira R.F. 2020. Genetic variation in the social environment affects behavioral phenotypes of oxytocin receptor mutants in zebrafish. eLife 2020;9:e56973.

3. Nunes A.R., Carreira L., Anbalagan S., Blechman J., Levkowitz G., Oliveira R.F. 2020. Perceptual mechanisms of social affiliation in zebrafish. Scientific Reports 10: 3642.

GROUP NAME

VARIATION: DEVELOPMENT AND SELECTION

RESEARCH GROUP LEADER

Patrícia Beldade

Research Interests: Eco-Evo-Devo research combines concepts and approaches from different disciplines (notably, evolutionary and developmental biology, as well as ecology) to explore the mechanisms that shape phenotypic variation and adaptation. Inter-individual variation is the raw material for natural selection, and a universal property of biological systems. Understanding the mechanisms that generate and shape this variation is a key challenge in biological research, and of obvious relevance also in biomedicine.

What are the gene types, specific genes, and gene regions that contribute to evolutionarily relevant variation? How do those genetic variants interact with environmental factors to regulate developmental trajectories and outcomes and account for phenotypic plasticity? For the dissection of variation in complex, diversified, and ecologically-relevant phenotypes the lab uses two complementary models: Bicyclus anynana butterflies and Drosophila melanogaster flies.

LAB MEMBERS

Beatriz Gil Felipe, MSc
Ana Teresa Eugénio, PhD student
Yara Katia Santos Rodrigues, PhD student
Roberto Arbore, Postdoc

GROUP NAME

BACTERIAL SIGNALLING

RESEARCH GROUP LEADER

Karina Xavier

The research group focuses on deciphering the molecular basis of how bacterial communication regulates bacterial behaviours. Researchers use biochemical and genetic approaches to study the molecular mechanisms underlying quorum sensing signalling in multi-species bacterial consortia. They want to understand the role of quorum sensing in assembly, maintenance and recovery of bacterial consortia and the consequences of these processes in the beneficial and hostile interactions that these communities establish with their hosts.

The research group recent work shows how bacterial chemical interactions shape multi-species bacterial communities and highlights the importance of inter-species interactions in modulating metabolic networks in bacterial communities such as the gut microbiota. Their aim is to take advantage of our recent findings to manipulate inter-species interactions in the mammalian gut towards strategies that counter microbiota imbalances and ameliorate host physiology.

/ HIGHLIGHTS IN 2020

The research group recent work highlights the importance of inter-species interactions in modulating metabolic networks in bacterial communities such as the gut microbiota. Using a gnotobiotic mouse model researchers showed that the gut microbiota shapes the gut metabolic environment driving E. coli adaptation to the mouse gut, revealing E. coli's metabolic versatility. (in Current Biology. Mar. 2020) They demonstrated the importance of microbiota transmission among hosts in recovery of antibiotic induced dysbiosis and identified a keystone species that is sufficient to restore colonization resistance against Enterobacteriaceae by a mechanism of nutrition competition. (in Nature Microbiology. April 2020). Researchers showed that the phytopathogen Erwinia carotovora (Ecc15) uses quorum sensing to regulate both its plant specific as well insect specific traits to infect the plant and to use the insect as vector. (Published in Mbio. Jun. 2020).

LAB MEMBERS IN 2020

Ana Matias, MSc
Miguel Pedro, Tecnician
Filipe Vieira, PhD student
Carina Galhofa, PhD student
Ana Rita Oliveira, Postdoc
Inês Mota Torcato, Postdoc
Vitor Cabral, Postdoc
Tanja Dapa, Postdoc
Joana Amaro, Lab Manager

RUNNING GRANTS

FCT Fundação para a Ciência e Tecnologia
EU Seventh Research Framework Programme, Marie Curie

NEW GRANTS 2020

FCT Fundação para a Ciência e Tecnologia

HONOURS

Karina Xavier invited Member of the Scientific Advisory Board of the Helmholtz Centre for Infection Research

PUBLICATIONS

1. Vieira FJD, Nadal-Jimenez P, Teixeira L, Xavier KB (2020) Erwinia carotovora quorum sensing system regulates host-specific virulence factors and development delay in Drosophila melanogaster.. **mbio** 11:e01292-20

2. R. A. Oliveira, K. M. Ng, M. B. Correia, V. Cabral, H. Shi, J. L. Sonnenburg, K. C. Huang, K. B. Xavier (2020)Klebsiella michiganensis transmission enhances resistance to Enterobacteriaceae gut invasion by nutrition competition. **Nature Microbiology** DOI: 10.1038/s41564-019-0658-4

3. Barroso-Batista, J., Pedro, M. F., Sales-Dias, J. , Pinto, C. J. G., Pereira, H. , Demengeot, J., Gordo, I., Xavier, K. (2020) Specific Eco-Evolutionary Contexts in the Mouse Gut Reveal Escherichia coli Metabolic Versatility.Current Biology

PROMOTING SCIENCE AND EMPOWERING SCIENTISTS AT THE IGC

ALEKOS ATHANASIADIS (1963-2020)

Alekos Athanasiadis joined the IGC as a group leader in 2009. In 2018 he became co-director of the IGC PhD program. Previous to his time at the IGC, Alekos had done a masters and PhD in Molecular biology and Crystallography of restrictions enzymes at the IMBB in Crete, followed by a postdoctoral work at ICGEB, Trieste, Italy. He then moved to a research position at the MIT, with Prof Alexander Rich, where with a Human Frontiers research fellowship, he started to work on structural and computational studies of the RNA editing process and the responsible enzymes (ADARs) until 2008. In 2009 Alekos started his **research group** at the IGC as a Marie Curie Research Fellow. His research focused on understanding how post-transcriptional RNA modifications create and fine-tune a much larger repertoire of proteins originating from a small number of genes. He was interested in the study of the molecular mechanisms involved in such diversification of RNA and DNA sequence, as well as understanding the consequences of such processes for molecular evolution dynamics. He was employing computational, molecular and structural biology tools, in particular to study the A to I RNA editing process which alters the sequence of thousands of human pre-mRNAs. This process has a prominent role in regulating Innate Immune responses to dsRNA.

Besides being an enthusiastic researcher that asked the most profound questions at seminars, Alekos was known for always having time to discuss and contribute to the work of all at the IGC, from student to PI. He helped many, many students and postdocs in the most diverse topics, from structure analysis, to protein purification, to the history of science.

The breadth of his knowledge of biology made his intellectual contributions particularly insightful and useful to us, his colleagues, from every discipline. He collaborated and co-authored papers with several research groups at the IGC but most of his human and scientific contributions will last in a not formally acknowledged manner in our memories and our hearts.

We will always remember Alekos enthusiastically discussing science with colleagues in the IGC patio.

Facilities

10
TECHNICAL FACILITIES

69
STAFF TECHNICAL FACILITIES

F **42**

M **27**

– **22** COLLABORATIONS

– **2** PATENTS PROTOTYPES

– **5** SOFTWARE DEVELOPED

– **28** PUBLICATIONS

– **50** EXTERNAL USERS

– **23** TALKS

– **5** HONOURS

– **1** PRIZES

ELECTRON MICROSCOPY FACILITY

SERVICE HEAD
ERIN TRANFIELD

SERVICE DESCRIPTION
- electron microscopy;
- technology development;
- teaching and training.

/ HIGHLIGHTS IN 2020

- hosting the COST Action Training School; leading a virtual international seminar series.

TEAM MEMBERS

Ana Vinagre, MSc
Ana Pacheco, MSc
Maria João Almeida, MSc
Erin Tranfield, PhD

NEW EQUIPMENT
IGC supported an upgrade on the TEM that let us remotely access the microscope. This was implemented Feb 2020 - little did I know how useful this would be in 2020 - I can monitor the TEM from my kitchen! Which has been superb for maintenance, training of my team (them at the microscope and me at home) etc.

PUBLICATIONS
1. Carvalho AS, Moraes MCS, Hyun Na C, Fierro-Monti I, Henriques A, Zahedi S, Bodo C, Tranfield EM, Sousa AL, Farinho A, Rodrigues LV, Pinto P, Bárbara C, Mota L, Abreu TT, Semedo J, Seixas S, Kumar P, Costa-Silva B, Pandey A, Matthiesen R. Is the Proteome of Bronchoalveolar Lavage Extracellular Vesicles a Marker of Advanced Lung Cancer? Cancers (Basel). 2020 Nov 20;12(11):3450. doi: 10.3390/cancers12113450.

2. Costa J, Pronto-Laborinho A, Pinto S, Gromicho M, Bonucci S, Tranfield E, Correia C, Alexandre BM, de Carvalho M. Investigating LGALS3BP/90K glycoprotein in the cerebrospinal fluid of patients with neurological diseases. Sci Rep. 2020 Mar 27;10(1):5649. doi: 10.1038/s41598-020-62592-w.

/ COVID-19 HIGHLIGHTS

Facility unit took the first pictures of SARS-COV2 in Portugal; the team supported the research from iMM on SARS-COV2.

COVID-19 RESEARCH
To obtain images of the virus in the supernatant and within cells.

STAFF INVOLVED
Ana Laura Sousa

OUTCOMES
We imaged the virus; first images in Portugal

BIOINFORMATICS FACILITY

SERVICE HEAD
JINGTAO LILUE

SERVICE DESCRIPTION
We are working for supporting the research groups in IGC. We provide a broad range of bioinformatic services, a one-stop-service from experimental design to final publication. We are also interested in population genetics, evolutionary genetics, mammalian genomes, transcriptomes and genome assembly algorithms.

/ HIGHLIGHTS IN 2020

Received 34 requests from internal and external research groups in 2020. Tracking the evolution of COVID19 under the mass pandemic and make the data public available. Participated in several research projects on rodent genome analysis, e.g. *Sigmodon hispidus, Acomys cahirinus and onychomys torridus.* Hosted several training projects for bioinformatic students and high school teachers (Curso Inspirar Ciência 2020 - Bioinformática).

TEAM MEMBERS

Miriam Corraliza (internship student), Visitor
Ricardo Ramiro, Postdoc
António Sousa, Technician

PUBLICATIONS

1. Ramiro RS, Durão P, Bank C, Gordo I. Low mutational load and high mutation rate variation in gut commensal bacteria. PLoS Biology 2020;18(3):e3000617.

/ COVID-19 HIGHLIGHTS

Collaborating with Wellcome Sanger Institute, we are tracking the mutations of COVID19. We are trying to establish a connection between mutations in S protein, and the raising of new infection cases. All these data are publicly available.

COVID-19 COLLABORATIONS
Internal | 2
International | 1

COVID-19 RESEARCH
Tracking the mutation of COVID19 Spike protein worldwide. Population genetics and selection of COVID19.

OUTCOMES
Publications with other research groups in IGC.

TRANSGENICS UNIT

SERVICE HEAD
MOISES MALLO

SERVICE DESCRIPTION
The Transgenics Unit generates genetically modified mouse and Drosophila strains for research groups at the IGC. The research team work with mice includes:
- Production of transgenic mice by pronuclear DNA injection using both conventional expression constructs and BACs.
- Introduction of targeted modifications into endogenous genomic loci both following embryonic stem cell-mediated approaches and with the CRISPR/Cas9 technology.
The team work with Drosophila melanogaster includes:
- A microinjection service to generate transgenic or mutant flies, via p-element, ΦC31, RNAi or CRISPR/Cas9 methods

/ HIGHLIGHTS IN 2020

Mouse transgenic embryos: 213 from 35 different constructs; Mouse transgenic founders: 24 from 8 different constructs; CRISPR/Cas9-mediated gene edition: 85 founder lines involving 15 different targettings; Drosophila transgenic lines generated: 48 through ΦC31 insertion, from which 20 were for RNAi-mediated inactivation, and 2 through random p-element insertion; Number of constructs built for Drosophila transgenesis: 22; Agreement signed with the Drosophila Genomics Resource Center (DGRC) to curate an entire copy of the Gold Collection clones at IGC and therefore be able to deliver clones in 24-48 hs to the Portuguese fly research community.

TEAM MEMBERS

Ana Nóvoa, Technician
Research Technician (mouse microinjection)
Leonardo Gaston Gilgur, Technician
Research Associate (Drosophila microinjection)

PUBLICATIONS
1. Dias, A., Lozovska, A., Wymeersch, F.J., Nóvoa, A., Binagui-Casas, A., Sobral, D. Martins, G.G., Wilson, V. & Mallo, M. (2020). A Tgfbr1/Snai1-dependent developmental module at the core of vertebrate axial elongation. eLife 9, e56615 **2.** de Lemos, L., Dias, A., Nóvoa, A. & Mallo, M. (2020). Epha1 is a cell surface marker for neuromesodermal progenitors and their early mesoderm derivatives. BioRxiv, 584524. **3.** Nabais, C., de-Carvalho, J., Pessoa, D., van Zanten, T., Mayor, S., Carneiro, J., Telley, I. A. & Bettencourt-Dias, M. (2020). Plk4 triggers autonomous de novo centriole biogenesis and maturation. BioRxiv 068650v1.

/ COVID-19 HIGHLIGHTS

The unit team have generated transgenic mice expressing the human Ace2 gene to facilitate experimental work on Covid19.

COVID-19 RESEARCH
Generation of mice expressing the human Ace2 gene

STAFF INVOLVED
Ana Nóvoa

COVID-19 COLLABORATIONS **| 4**

OUTCOMES
Four transgenic lines successfully generated; Team is generating mice with a humanized endogenous Ace2 gene.

FLOW CYTOMETRY AND ANTIBODIES

SERVICE HEAD
MARTA MONTEIRO

SERVICE DESCRIPTION
The Flow Cytometry & Antibodies Facility offers flow cytometry and antibodies-related services and expertise to IGC researchers, as well as to outside groups and companies. The focus of our services is: 1) To facilitate the access to state-of-the-art flow cytometry techniques and instrumentation; 2) To develop and implement new methods and solutions to support project development; 3) To offer scientific and technical support; 4) To provide easy access to monoclonal antibodies; 5) To promote advanced training and the best practices in Flow Cytometry.
Instrumentation includes two multicolor high-speed cell sorters, three 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.

/ HIGHLIGHTS IN 2020

In 2020, the Flow Cytometry Facility embraced a new challenge: the integration of the Antibodies Unit in its service and the transition to the Flow Cytometry & Antibodies Facility. With a larger team, we took the opportunity of improving our know-how and restructuring the portfolio of services to provide solutions better tailored to the research community needs. The Facility has also acquired a new cytometer - a full spectrum analyzer CYTEK Aurora, equipped with four LASERs and providing high sensitivity and opportunities to increase dimensionality. Finally, the facility launched the first Portuguese blog fully dedicated to Flow Cytometry: Go With The Flow (https://gowiththeflow-pt.blogspot.com/).

TEAM MEMBERS

Ana Teresa Branco and Denise Brito, MSc Holder
Flow Cytometry and Antibodies Research Support Specialist
Marta Monteiro - Head of Facility, PhD Holder
Ana Regalado - Facility Manager, PhD Holder

NEW EQUIPMENT

4 LASER CYTEK Aurora funded 40% by Lisbon Region Operational Program 2014-2020 (European Structural fund FEDER) & 60% by Fundação Calouste Gulbenkian core funding.

PUBLICATIONS

1. Julie Auger, Luellen Fletcher, Shawn Frankowiak, George Grills, M Victor Lemas, Sheenah Mische, Marta Monteiro, Fernando Peláez, Diane Tabarini, Andrew Vinard, A Nicole White. SRLs in a Global Pandemic: An Administrative Perspective. Cytometry A. 2020 Nov. PMID: 33188580 PMCID: PMC7753372 DOI: 10.1002/cyto.a.24263.

MODEL ORGANISM FACILITY

SERVICE HEAD
MANUEL REBELO

/ HIGHLIGHTS IN 2020

Organization of the V National Symposium of ORBEAs.

/ COVID-19 HIGHLIGHTS

The facility made available for Covid-19 activities at IGC an isolator to manipulate human samples in a safe way for the operator, and a H2O2 vaporizer to decontaminate the outside surface of the samples before manipulation.

TEAM MEMBERS

Sandra Crisóstomo, BSc Holder
Bsc, Specialized Technician
Ana Sofia Leocádio, BSc Holder
Bsc, Specialized Technician
Ana Ribeiro, BSc Holder
Bsc, Specialized Technician
Liliana Vale, BSc Holder
Bsc, Specialized Technician
Adérito Vieira, BSc Holder
Bsc, Specialized Technician
Ana Raquel Machado, BSc Holder
Bsc, Specialized Technician
Inês Matado, BSc Holder
Bsc, Animal Technician Intern

Joana Bom, MSc Holder
Msc, Manager of the Mouse Facility
Liliana Vieira, MSc Holder
Msc, Manager of the Fly Facility
Vera Nunes, MSc Holder
Msc, Manager of the Plant Facility
Maysa Franco, MSc Holder
Msc, Specialized Technician
Marília Pereira, MSc Holder
Msc, Specialized Technician
Inês Santos, MSc Holder
Msc, Specialized Technician
Pedro Pinto, MSc Holder
Msc, Specialized Technician

Ana Cristina Borges, PhD Holder
Phd, Manager of the Aquatic Facility;
Rute Marques, PhD Holder
Phd, Animal Welfare Officer.

Carla Almada, Animal Care Staff;
Cláudia Gafaniz, Animal Care Staff;
João Lopes, Animal Care Staff;

Lévi Pires, Animal Care Staff;
Marco Rocha, Animal Care Staff;
Mário Rocha, Animal Care Staff;
Carine Santos, Animal Care Staff;
Rodrigo Pires, Animal Care Staff.

STAFF INVOLVED IN COVID19 EFFORTS:

Joana Bom,
Internal Volunteers management,
and Volunteer (RNA extraction).

Marília Pereira,
Volunteer (RNA extraction).

RUNNING GRANTS

National | LISBOA-01-0145-FEDER-022170 (CONGENTO)
International | H2020-INFRADEV

NEW EQUIPMENT

Mouse Metabolic Cages; co-funded by UIDB – Unidade de Investigação 2020 and LISBOA-01-0145-FEDER-022170 (CONGENTO); Chamber FitoClima S600PLH LED2; PTDC/BIA-BID/30608/2017

PUBLICATIONS

1. "Microbiota Alters Urinary Bladder Weight and Gene Expression". Blanka Roje, Anamaria Elek, Vinko Palada, Joana Bom, Aida Iljazović, Ana Šimić, Lana Sušak, Katarina Vilović, Till Strowig, Kristian Vlahoviček and Janoš Terzić.Microorganisms2020,8(3),421; https://doi.org/10.3390/microorganisms8030421.

HISTOPATHOLOGY FACILITY

SERVICE HEAD
PEDRO FAÍSCA

SERVICE DESCRIPTION
Histology services/ pathology assessment/ Quantitative pathology (Stereology/Image Analysis)/ Immunohistochemistry

MAIN ACHIEVEMENTS IN 2020

Protocol developments:
Stereological quantification of murine intestinal tract/Open swiss-roll technique/Stereological quantification of murine gonads;

Techniques:
Resin embedding/immunohistochemistry service implementation

TEAM MEMBERS

Joana Rodrigues Lóios Facility Manager, Technician
Andreia Mindouro, Technician
Mafalda Casanova Junior Pathologist, Technician

NEW EQUIPMENT
Leica Automate Microtome - IGC funding;
Visiopharm software for Stereology - IGC funding

PUBLICATIONS

1. Deletion of iRhom2 protects against diet-induced obesity by increasing thermogenesis. Badenes M, Amin A, González-García I, Félix I, Burbridge E, Cavadas M, Ortega FJ, de Carvalho É, Faísca P, Carobbio S, Seixas E, Pedroso D, Neves-Costa A, Moita LF, Fernández-Real JM, Vidal-Puig A, Domingos A, López M, Adrain C. Mol Metab. 2020 Jan;31:67-84. doi: 10.1016/j.molmet.2019.10.006. Epub 2019 Oct 31.
2. Tetracycline Antibiotics Induce Host-Dependent Disease Tolerance to Infection. Colaço HG, Barros A, Neves-Costa A, Seixas E, Pedroso D, Velho T, Willmann KL, Faisca P, Grabmann G, Yi HS, Shong M, Benes V, Weis S, Köcher T, Moita LF. Immunity. 2021 Jan 12;54(1):53-67.e7. doi: 10.1016/j.immuni.2020.09.011. Epub 2020 Oct 14.
3. The multifaceted Foxp3fgfp allele enhances spontaneous and therapeutic immune surveillance of cancer in mice. Almeida-Santos J, Bergman ML, Amendoeira Cabral I, Correia V, Caramalho Í, Demengeot J. Eur J Immunol. 2020 Mar;50(3):439-444. doi: 10.1002/eji.201948251. Epub 2019 Nov 27.

/ COVID-19 HIGHLIGHTS

Stereological quantification of murine models of acute lung injury development for future murine covid models

COVID-19 RESEARCH
Stereological quantification of murine models of acute lung injury. Aims: Develop a quantitative histopathological method for acute lung injury murine models.

COVID-19 COLLABORATIONS | 1

STAFF INVOLVED
Mafalda Casanova, Ana Laura Vinagre, Joana Rodrigues Lóios, Andreia Mindouro, Erin Tranfield, Pedro Faísca.

OUTCOMES
Develop a quantitative histopathological method that can be used to assess lung lesions in COVID murine models.

ADVANCED IMAGING FACILITY

SERVICE HEAD
GABRIEL G. MARTINS

SERVICE DESCRIPTION
Imaging technology and bioimage data analysis; Mesoscopy and Nanoscopy; Development and maintenance of optical systems

/ HIGHLIGHTS IN 2020

José Marques and Donald Fowler joined the team; Installation of the Zeiss Z.1 lightsheet system; Full implementation of AiryScan2 and Apotome systems; Implementation of deep learning algorithms for image restoration and segmentation.

TEAM MEMBERS

Alexandre Lopes, MSc Holder
MsC, Developer and microscopy assistant
José Marques, MSc Holder
MsC - Microscopy Assistant
Gabriel G Martins, PhD Holder
PhD - Head;
Donald Fowler, PhD Holder
PhD - Post-doc and Microscopy Assistant
Mária Hanulová, PhD Holder
PhD - Microscopy Assistant

RUNNING GRANTS
FCT Fundação para a Ciência e Tecnologia
COST action

NEW EQUIPMENT
Zeiss Z.1 Light-sheet (FCG)

PATENS AND PROTOTYPES
New implementation of correlative Mesoscope

NETWORKS/ ALLIANCES
PPBI - Portuguese Platform for Bioimaging and COLife; EuroBioimaging; NEUBIAS; Quarep-LiMI; COMULIS

PUBLICATIONS

1. Seco P, Martins GG, Jacinto A, Tavares AT. 2020. A Bird's Eye View on the Origin of Aortic Hemogenic Endothelial Cells https://doi.org/10.3389/fcell.2020.605274

2. Dias A, Lozovska A, Wymeersch FJ, Novoa A, Binagui-Casas A, Sobral D, Martins GG, Wilson V, Mallo M. A 2020. A Tgfbr1/Snai1-dependent developmental module at the core of vertebrate axial elongation. eLife. https://doi.org/10.7554/eLife.56615 and bioRxiv. https://doi.org/10.1101/2020.03.09.983809".

COVID-19 COLLABORATIONS
Preparation of macro and workflow for analysis of images of serological test cassetes; Participation in project FCT Proj soluções inovadoras - COVID-19 #580 "A practical assay for routine detection of neutralizing antibodies against SARSCoV2 that bypasses requirements for high biosafety laboratory usage".

QUANTITATIVE BIOLOGY & DIGITAL SCIENCE

SERVICE HEAD
TIAGO PAIXÃO

SERVICE DESCRIPTION
The unit provides data analysis, computational biology, mathematical modelling and experimental design services. Furthermore, the unit also provides support in the field of research data management.

/ HIGHLIGHTS IN 2020

The unit started in February 2020. Since then, the unit has assisted more than 12 groups at IGC and was involved in more than 15 projects. The unit was heavily involved in the PhD program, providing most PhD modules with a quantitative perspective.

The unit is introducing computational notebooks and data management best practices to the scientific workflow of the institute and is helping coordinate the digital transition at the institute, starting with the transition to electronic lab books.

/ COVID-19 HIGHLIGHTS

The team developed an app to assist with personal contact tracing (April 2020). We developed a framework to optimally estimate SARS-CoV2 antibodies prevalence (for serological population studies) that takes into account the uncertainties of the performance data of the test used. Also developed a model that integrates results from serological testing to provide improved classifier performance.

NEW GRANTS
FCT - High Performance computing grant
EMBO workshop grant (postponed to 2022)

NEW EQUIPMENT
Server providing computational services and data infrastructure for IGC.

GENOMIC UNIT

SERVICE HEAD
RICARDO LEITE

SERVICE DESCRIPTION
Technical platform

/ HIGHLIGHTS IN 2020

Establishment of 10x genomics platform (scRNA-SEQ; TCR); Automatization of SARS-CoV-2 RNA extraction, Fast establishment of a SARS-CoV-2 sequencing and analysis pipeline. Collaboration with hospitals and public entities for SARS-CoV-2 PCR testing.

TEAM MEMBERS
João Costa, Technician
João Sobral, Technician
Cathy Paulino, Technician
Susana Ladeiro, Technician
Maria Costa, Postdoc
Asunción Lago-Lestón, Visitor
(Univ. Baja California, México)

RUNNING GRANTS
GenomePT; ONEIDA; FCT-Covid
New Grants: Single Cell Hub: Tornar o invisível, visível, na saúde e na doença - Programa Operacional Regional de Lisboa sponsored by the European Structural fund FEDER

SOFTWARE DEVELOPED
D-Cellerate https://github.com/BioData-PT/D-cellerate;
Virtool - https://github.com/joaomatos02/Virtool;
Genoqual2 https://github.com/Genomic-Unit-IGC/genoqual

PUBLICATIONS

1. 10.1038/s41598-020-64774-y Catarina Churro; Ana P. Semedo-Aguiar; Alexandra D. Silva; Jose B. Pereira-Leal; Ricardo B. Leite. "A novel cyanobacterial geosmin producer, revising GeoA distribution and dispersion patterns in Bacteria". Scientific Reports 10 1 (2020): https://doi.org/10.1038/s41598-020-64774-y.

2. Vítor Borges; Joana Isidro; Helena Cortes-Martins; Sílvia Duarte; Luís Vieira; Ricardo Leite; Isabel Gordo; et al. "Massive dissemination of a SARS-CoV-2 Spike Y839 variant in Portugal". Emerging Microbes & Infections (2020): https://doi.org/10.1080/22221751.2020.1844552.

3. Leite, Ricardo B. "Expression of four new ferritins from grooved carpet shell clam Ruditapes decussatus challenged with Perkinsus olseni and metals (Cd, Cu and Zn)". Aquatic Toxicology (2020): 105675-105675. http://dx.doi.org/10.1016/j.aquatox.2020.105675.

/ COVID-19 HIGHLIGHTS

Sequencing of ~1000 SARS-CoV-2 viral genomes; Participation in the academic network of PCR testing, Participation in the Portuguese variants monitoring program; Development of a protocol for simultaneous sequencing of Virus genome and ACE2 Support for internal and external Covid Projects.

COVID-19 RESEARCH
"Predicting SARS-CoV-2 susceptibility by tracking the genetic variability of the ACE2 receptor"- FCT-Covid.

COVID-19 OUTCOMES:
The unit have performed thousands of tests. For the public hospitals during the initial months of Covid testing, providing PCR tests (together with the amazing volunteer work of many colleagues) and supported the INSA survey program for analysis of genetic variants of the SARS-CoV-2. The Unit have supported the development of a fast saliva testing (Maria João Amorim Lab).

Services

Services

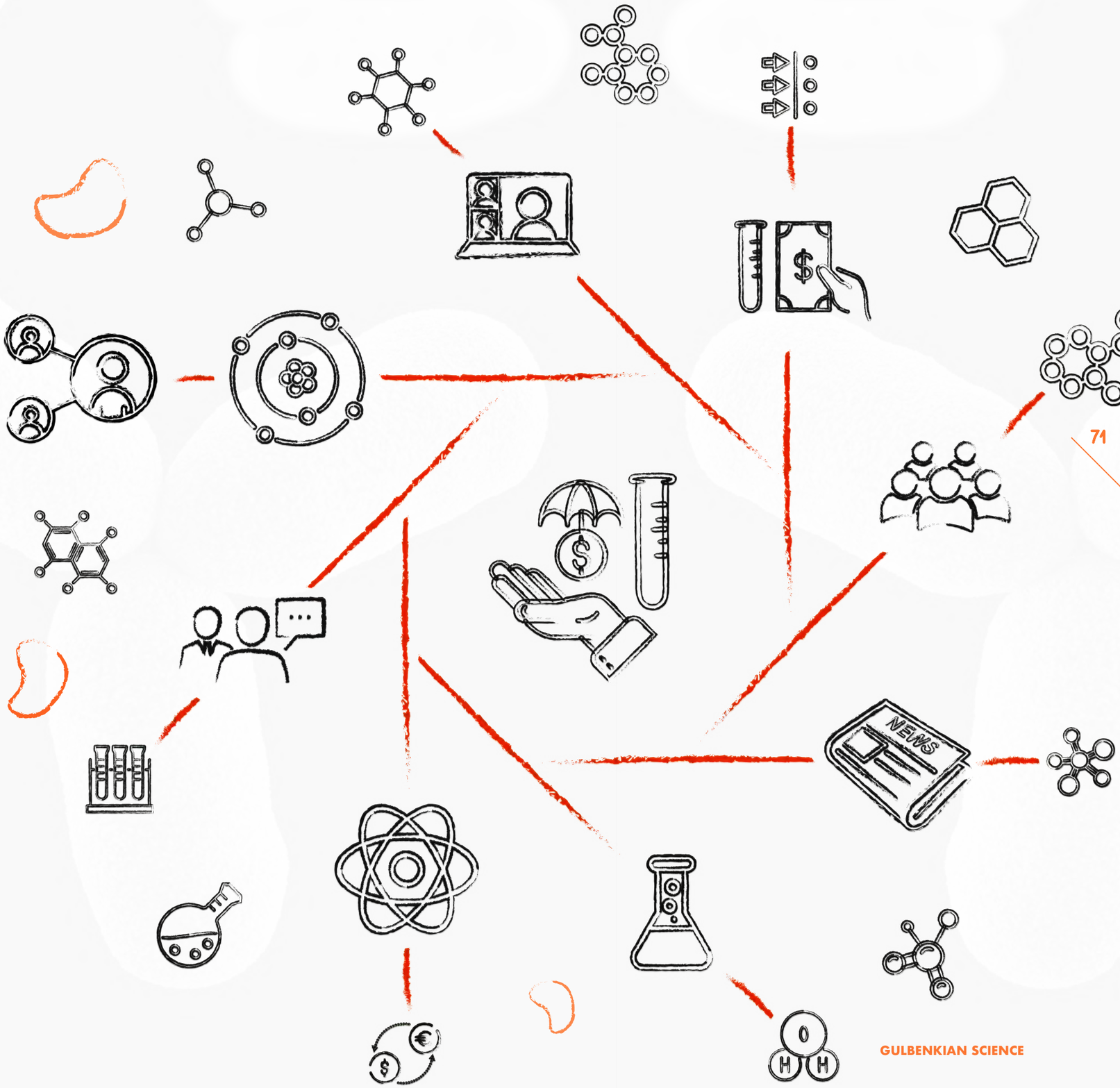
12
NUMBER OF SERVICES

73
STAFF SERVICES

F **41**

M **32**

- Biosafety
- Events & Welcome team
- Human Resources
- Informatics
- Innovation
- Institutional Communication
- Maintenance
- Procurement
- Project Management & Accounting
- Public Engagement
- Research Funding Affairs
- Technico-Scientific Support



GULBENKIAN COLLABORATIVE CENTRE

246 Talks
58 National
188 International

14 Events Organized
6 Conferences/Symposia
4 Workshops
4 Courses

Created in 2019, the Gulbenkian Collaborative Centre promotes the development of life sciences by enhancing interdisciplinary and collaborative research and by reducing inequality in the access to scientific knowledge. The Collaborative Centre admnisters a sabbatical programme and organizes lectures, courses, conferences and postgraduate training events. The Centre also created fellowships and prizes and coordinates the selection of the awardees.

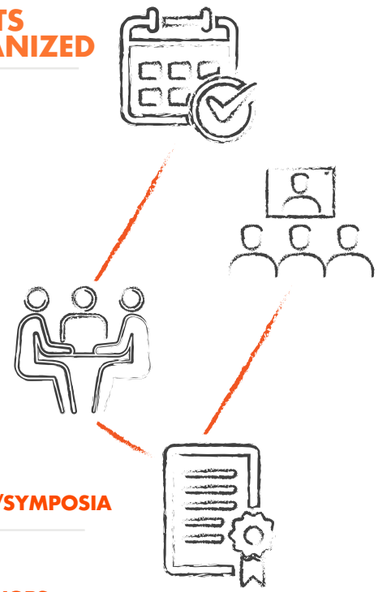
In 2020, the Centre developed a sabbatical program, created and awarded prizes and scholarships and organised courses, workshops and other postgraduate training activities. In 2020 there were eight sabbatical visits to the IGC, each offering unique opportunities to establish synergies with external researchers. The Centre organised a virtual international conference sponsored by EMBO, one of the most prestigious scientific organisations in the world. Together with the Oeiras City Council, it launched the "Oeiras - ERC Frontier Research Incentive Awards" - an award that aims to attract and retain top scientists. Also in 2020, it held the second edition of the António Coutinho Scholarships, which aims to provide scientific training to citizens or descendants of Portuguese speaking African Countries, as well as increasing diversity in the scientific community.

246 TALKS

58 NATIONAL

188 INTERNATIONAL

14 EVENTS ORGANIZED



6 CONFERENCES/SYMPOSIA

4 WORKSHOPS

4 COURSES

INNOVATION AND TECH TRANSFER

120 Innovation Projects
70 Agreements
1 Lincensing Agreement

Innovation and tech transfer activities are part of the IGC strategy. The Innovation Unit is focused on the identification, protection and adequate exploration of ideas with added value that can dynamize relations with the regional, national and international industrial and business actors. In 2020 this structure followed, 120 innovation projects. This resulted in the establishment and negotiation of more than 70 agreements, including scientific and technological collaborations with hospitals and companies.

In close articulation with the Foundation legal office, it also conducted the negotiation and implementation of the first licensing agreement of the FCG-IGC regarding the serological test developed within the scope of the Serology4COVID consortium, led by the FCG-IGC, to the pharmaceutical company Medinfar. This Unit maintains the management of this strategic partnership, as well as with other key partners such as CUF and Instituto Superior Técnico.

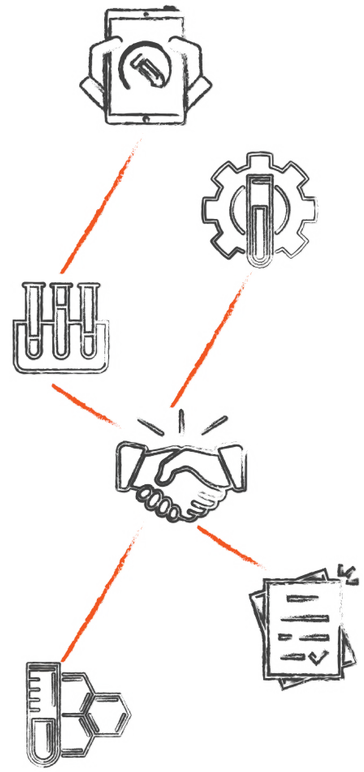
During a particularly critical year, this unit actively supported several proposals for public funding for translational research, contributing to the attraction of significant funds for the development of projects associated with COVID19.

The various activities promoted by the Innovation Unit increase the impact of the science produced at the IGC by bringing it closer to clinical practice, industrial fabric and society, with a direct result in the Institute's international visibility and reputation.

120 INNOVATION PROJECTS

70 AGREEMENTS

1 LINCENSING AGREEMENT



Training @IGC

TRAINING @IGC

Training @IGC

UNDERGRADUATE SUMMER SCHOOL PROGRAMME

STUDENTS ADMITTED | 91

COORDINATORS:
Maria João Amorim,
Luís Teixeira
Gabriel Martins

TRAINING UNIT MEMBERS:
Alexandra Caetano
Ana Aranda da Silva

PROGRAMME DESCRIPTION:
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, because of the pandemic, the event was online with 91 participants from 8 different nationalities (Brazil, Cape Verde, Egypt, India, Portugal, Serbia, Slovenia, Spain, UK and USA). The Programme initiated on the 29th July with a week of classes, ending with a final discussion on SARS-COV-2 possibilities of training at IGC. The Programme had great positive feedback from the students and we already had enquiries from several national and international students about the next edition.

/ HIGHLIGHTS IN 2020

The move to an online format allowed us to reach 91 participants in the programme.

MODULES/COURSES HELD

Participating Groups in 2020:

Cell Cycle Regulation Lab, Chromosome Dynamics Lab, Mechanisms of Morphogenesis Lab, Host-Microorganisms Interactions Lab, Evolutionary Biology Lab, Population and Conservation genetics Lab, Plant Stress Signalling Lab, Cell Biology of Viral Infection Lab, Plant Molecular Biology Lab, Optical Cell Biology, Light Microscopy Facility, Electron Microscopy Facility, Flow Cytometry Facility, Public Engagement Unit, Technical Scientific Support Unit, Quantitative Organismal Biology Unit.

List of IGC Participants:

- **Ana Confraria,**
- **Ana Mena,**
- **Bárbara Parreira,**
- **Bruno Peixoto,**
- **Catarina Carmo,**
- **Catarina Nabais,**
- **Elena Baena,**
- **Elias Barriga,**
- **Erin Tranfield,**
- **Fernando Ferreira,**
- **Gabriel G Martins,**
- **Gonçalo Matos,**
- **Inês Carvalho,**
- **Isabel Gordo,**
- **Joana Saraiva,**
- **Jorge Carneiro,**
- **Lounès Chikhi,**
- **Luís Teixeira,**
- **Mafalda Pimentel,**
- **Maria João Amorim,**
- **Marta Monteiro,**
- **Mónica Bettencourt-Dias,**
- **Nuno Moreno,**
- **Paula Duque,**
- **Paulo Navarro-Costa,**
- **Raquel Oliveira,**
- **Ricardo Henriques,**
- **Sara Carvalhal,**
- **Tiago Paixão.**

PhD PROGRAMME

PhD Thesis Defended 2020: 7
STUDENTS ADMITTED | 16

COLLABORATIONS
National | 2
International | 1

COORDINATORS:
Jorge Carneiro, Élio Sucena and Alekos Athanasiadis

TRAINING UNIT MEMBERS:
Alexandra Caetano, Ana Aranda da Silva

PROGRAMME DESCRIPTION:
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 come from all over the globe, and diverse academic backgrounds. The class of 2019 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.

/ PhD Thesis Defended 2020

1) Maria Inês Machado Mahú (IBB2014) - Determining the role of Sympathetic Nervous System Activity in the control of Body-Weight and Metabolism – defended on 20/11/2020

2) Yara Katia Santos Rodrigues (PGCD2015) - Seasonal plasticity in insect models: effects of variable temperatures on developmental outcome – defended on 19/10/2020

3) Eleonora Tulumello (IBB2015) - Robust tolerance out of volatile regulatory T cells. Lessons from mathematical modelling – defended on 10/07/2020

4) Ibukun Dorcas Fatunke Akinrinade (IBB2015) - Oxytocinergic modulation of social information use in threat perception – defended on 07/06/2020

5) Luís Manuel Figueira Leónidas Correia Cardoso (IBB2015) - The role of the gut microbiota in the subsistence of antibiotic resistance – defended on 06/03/2020

6) Henrique Guerra Gonçalves Colaço (IBB2015) - Organismal homeostasis in sepsis: The role of mitochondrial function and metabolism – defended on 17/01/2020

7) Ana Rita Almeida de Oliveira (IBB2015) - Interspecies interactions in recovery of gut microbiota functions – defended on 13/01/2020

STUDENTS ADMITTED

IBB2019:
Carina Galhofa (PT), **Christian Diwo** (DE), **Francisco Paupério** (PT), **Joana Saraiva** (PT), **Kátia Jesus** (PT), **Lucrezia Ferme** (IT), **Mariana Gil** (PT), **Priscilla Akyaw** (GH) and **Romana Yañez** (CU).
IBB2020:
Afonso Mendes (PT), Camila Mariano (PT), Catarina Pedro (PT), Maria Montoya (VE), Mariana Natalino (PT), Ravi Vishwakarma (IN), Víctor Mello (BR)

MODULES/COURSES HELD **| 14**

Plant Biology (06-10/01/2020)

Organiser: Elena Baena, Jorg Becker and Paula Duque
Faculty: Elena Baena, Jorg Becker and Paula Duque, IGC, Andreas Weber, Johana Misas-Villami and Ute Hoecker, Uuniversity of Cologne"

Hypothesis Driven Research (15-24/01/2020)

Organiser: Isabel Gordo and Tiago Paixão
Faculty: Isabel Gordo and Tiago Paixão, IGC, Daniel Gerlich, Austrian Academy of Sciences in Vienna

History of Biological Concepts (07-11/09/2020)

Organiser: Élio Sucena
Faculty: Ana Simões, Centro Interuniversitário de História das Ciências e Tecnologia, Faculdade de Ciências, Universidade de Lisboa, Michael Dietrich, History and Philosophy of Science, University of Pittsburgh, Lars Jansen, Department of Biochemistry, University of Oxford, Thiago Carvalho, Fundação Champalimaud, Elio Sucena and Jorge Carneiro, IGC

Statistics and Quantitative Biology (14-18, 23-25/09/2020)

Organisers: Jorge Carneiro and Tiago Paixão
Faculty: Jorge Carneiro and Tiago Paixão, IGC

Structural and Molecular Biology (21-23/09/2020)

Organisers: Bruno Correia
Faculty: Bruno Correia, EPFL, Switzerland, Tiago Cordeiro, ITQB, Eric Westhof, IBMC, Strasbourg, France

Biophysics (28/09-02/10/2020)

Organisers: Ivo Telley
Faculty: Rosalina Fonseca, CEDOC, Nenad Pavin, University of Zagreb, Stefan Diez, TU Dresden, Thomas Surrey, CRG Barcelona, Gabriel Martins, Ricardo Henriques, Ivo Telley and Jorge Carneiro, IGC

Inside the Cell and Cell Biology (06-23/10/2020)

Organisers: Raquel Oliveira
Faculty: Raquel Oliveira, Monica Bettencourt-Dias, Ricardo Henriques, Maria João Amorim, Caren Norden, Ivo Telley and Tiago Paixão, IGC. Edgar Gomes, IMM, Lisbon, Portugal, Marco Fumasoni, Department of Molecular and Cellular Biology, Harvard University, USA, Duarte Barral, CEDOC, Lisbon, Portugal, Colin Adrain, Queen's University Belfast, Ireland, Tim Nott, Department of Biochemistry, University of Oxford, UK, Jennifer Lippincott-Schwartz, Howard Hughes Medical Institute's Janelia Research Campus, USA, Guillaume Charras, UCL, London, UK, Carl Modes, MPI-CBG and the Center for Systems Biology Dresden (CSBD), Germany, Nicoletta Petridou, EMBL

Developmental Biology (26-30/10/2020)

Organisers: Moisés Mallo
Faculty: Alfonso Martinez-Arias, University of Cambridge, Cambridge, UK, Darui Lupiañez, Max-Delbruck Center for Molecular Medicine, Berlin, Germany, Deneen Wellik, University of Wisconsin-Madison, USA, Elias Barriga, IGC, Élio Sucena, IGC, Leonor Saúde, IMM, Scott Gilbert. Swarthmore College, Swarthmore, USA and Tiago Paixão, IGC

Systems Biology (02-06/11/2020)

Organisers: Jorge Carneiro and Tiago Paixão
Faculty: Jorge Carneiro, IGC, Tiago Paixão, IGC, Aurelien Naldi, Lifeware, INRIA Saclay-Île-de-France, France Erida Gjini, Center for Computational and Stochastic Mathematics, Instituto Superior Técnico, Lisbon Francisco Paupério, IBB and IGC, Rob de Boer. Theoretical Biology and Bioinformatics. University of Utrecht, The Netherlands.

Evolution (09-13/11/2020)

Organisers: Isabel Gordo
Faculty: Lounès Chikhi, Isabel Gordo, Tiago Paixão, Jorge Moura de Sousa, Marta Lourenço, Massimo Amicone, Katherine Coyte

Eco-Evo-Devo (16-20/11/2020)

Organisers: Élio Sucena
Faculty: Abderrahman (Abdou) Khila (IGFL, Lyon, France), Alistair McGregor (Oxford Brookes University, UK), Antónia Monteiro (NUS, Singapore), Christian (Chris) Braendle (Nice University, France), Christen Mirth (Monash University, Australia), Johannes (Yogi) Jaeger (Complexity Science Hub (CSH) Vienna, Austria), Patrícia Beldade (IGC), Tiago Paixão (IGC), Élio Sucena (IGC)

Immunobiology & Host-Pathogen Interactions (23/11-04/12/2020)

Andrew McPherson. University of Bern, Switzerland. António Coutinho. IGC and Fundação Champalimaud. Barbara Rehermann. National Institute of Diabetes and Digestive and Kidney Diseases, NIH, Bethesda, USA. Bruno Lemaitre. EPFL, Lausanne, Switzerland. Caetano Reis e Sousa. The Francis Crick Institute, London, UK. Dieter Ebert. University of Basel, Switzerland. Eric Martens. University of Michigan Medical School, Ann Arbor, USA. Gabriel Nuñez. University of Michigan Medical School, Ann Arbor, USA. Martin Kaltenpoth. Johannes Gutenberg University, Mainz, Germany. Max Planck Institute for Chemical Ecology, Jena, Germany. Nicole Dubilier. Max Planck Institute for Marine Microbiology, Bremen, Germany. Paul Schulze-Lefert. Max Planck Institute for Plant Breeding Research, Cologne, Germany. Thomas Pradeu. University of Bordeaux, France. Thiago Carvalho. Fundação Champalimaud, Lisbon, Portugal Vasco Barreto. CEDOC – NOVA Medical School, Lisbon, Portugal Jocelyne Demengeot, IGC. Jonathan Howard, IGC. Karina Xavier, IGC. Luis Teixeira, IGC. Miguel Soares, IGC. Nelson Martins, IGC. Tiago Paixão, IGC. Vera Martins, IGC.

Neurobiology (07-11/12/2020)

Organisers: Rui Oliveira
Faculty: Rui Oliveira. IGC/ISPA. Lisboa. Gil Levkowitz. Weizmann Institute, Israel. Luísa Vasconcelos. CR, Lisboa. Marta Moita. CR, Lisboa. João Peça. CNC, Univ. Coimbra. Alex Jordan. Max Planck Institute of Animal Behaviour. Germany. Kyriakos Kareklas (IGC, Oeiras), Ana Rita Nunes (IGC, Oeiras), Magda Teles (IGC, Oeiras), and Susana Varela (IGC, Oeiras)

Plant Biology (14-18/12/2020)

Organisers: Paula Duque
Faculty: Elena Baena-González, IGC, Jörg Becker, IGC, Paula Duque, IGC, Ute Höcker. University of Cologne, Germany, Andreas Weber. University of Duesseldorf, Germany and Jane Parker. Max Planck Institute for Plant Breeding Research, Germany

POSTDOCTORAL PROGRAMME BIOLOGY BY NUMBERS

STUDENTS ADMITTED | 2
MODULES/COURSES HELD| 14

COORDINATORS:
Isabel Gordo

TRAINING UNIT MEMBERS:
Alexandra Caetano
Ana Aranda da Silva

PROGRAMME DESCRIPTION:

The Postdoctoral Programme Biology by Numbers is a multidisciplinary Programme for PhD holders from Exact Sciences & Engineering with little knowledge on/great curiosity for fundamental biological questions. Selected Postdoctoral researchers are offered advanced courses, starting in September 2020, covering both basic concepts and cutting-edge research in modern biology. Module topics range from structural and molecular biology to evolution and ecology and are taught by IGC faculty and invited lecturers from top universities and research institutes all over the world. At the end of the proposed classes, postdoctoral researchers will develop a research proposal with the support of their chosen IGC principal investigators in order to apply for extramural fellowships.

/ Main achievements in 2020

Cècil Carrere gained a position with CNRS, Institut Denis Poisson Université d'Orléans.

TRAINING PROGRAMME IN BIOINFORMATICS (GTPB)

HEAD: PEDRO L. FERNANDES

SERVICE EXTERNAL USERS:
National | 18
International | 2

SERVICE DESCRIPTION:

The Gulbenkian Training Programme in Bioinformatics (GTPB) is dedicated to the provision of an environment that optimally delivers skills to researchers and students, since 1999. In 2020, the ability to run training courses in IGC´s Bioinformatics Training Room due to the pandemic situation has shifted our focus to the consolidation of the training methods and the development of materials. It was still possible to run an applied Biostatistics course before the lockdown.

/ HIGHLIGHTS IN 2020

PSLS20 Practical Statistics for the Life Sciences (Jan 20-24 2021) with Lieve Clement and Jeroen Gills, both from the University of Ghent, BE was fully attended (20 participants).

TEAM MEMBERS
Miguel Cardoso internship with BioData.pt,
Technician

COLLABORATIONS
BioData.pt
Network/Alliances: ELIXIR, GOBLET

EVENTS ORGANIZED
Training Course
PSLS20 training course (Jan 20-24 2020)
20 participants
ELIXIR Train-the-Trainer (October 6-9 2020)
17 participants, online

EVENTS ORGANIZED

- **Train-the-Trainer course for service unit or core facility technicians @IGC**
- **Feb 6th 2020 (17 participants from IGC)**

PAPERS
Gurwitz KT, Singh Gaur P, Bellis LJ, Larcombe L, Alloza E, Balint BL, et al. (2020) A framework to assess the quality and impact of bioinformatics training across ELIXIR. PLoS Comput Biol 16(7): e1007976. https://doi.org/10.1371/journal.pcbi.1007976

RESEARCH STRUCTURES

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

EXECUTIVE DIRECTOR:
Ana Portugal Melo (IGC)

BIODATA.PT

Is the Portuguese Infrastructure for Biological Data, operating the Portuguese node of ELIXIR - European Distributed Infrastructure for Biological Data. It supports the research strategy and programs of the national scientific system through a distributed computing infrastructure and a network of bioinformatics and data management experts, promoting scientific research in the agri-food and forestry, sea and health sectors. Co-coordinated by the IGC and INESC-ID, it is a Consortium of 12 Portuguese organizations, from Braga to Algarve.

IGC GENOMIC UNIT:
Ricardo Leite

GENOMEPT

NATIONAL FACILITY FOR GENOME SEQUENCING AND ANALYSIS

A distributed genome sequencing and analysis infrastructure integrated in the Portuguese Roadmap of Research Infrastructures. It congregates over 50 researchers and technical personnel and amasses important bioinformatics expertise into a single genomics consortium. GenomePT provides sequencing and bioinformatics services for genome projects coordinated by national and international partners, including the national health service, food, pharma, biotech, paper, wine and fishing industries. The main mission is to build the research capacity and align research strategy with Regional and National development priorities to make tangible contributions to regional development, the national economy and fixation of highly qualified human resources in Portugal.

TEJO & ALGARVE COORDINATOR:
Gabriel Martins (IGC)

PPBI

PORTUGUESE PLATFORM OF BIOIMAGE

The Portuguese Platform of Bioimage is a common functional platform dedicated to promoting the technical integration and centralized management of shared resources in bioimaging. Organized as a consortium of top research universities and institutes in Portugal, the PPBI services focus on advanced microscopy and processing/analysis of images in the life-sciences, from cell & developmental biology, neurosciences, oncobiology, immunology, infection, and regenerative medicine. Currently, PPBI consists of 16 Nodes distributed by 3 regional poles (DOURO & MINHO, MONDEGO & BEIRAS, TEJO & ALGARVE), comprising more than 100 high-end equipment resources supported by Ph.D. experts in bioimaging. Access to PPBI resources and services is open to all scientific community, as well as industry.

STEERING COMMITTEE:
Jocelyne Demengeot (IGC)

CONGENTO

CONSORTIUM OF GENETICALLY TRACTABLE ORGANISMS

Portuguese Research Infrastructure for technology development across animal models, providing state-of-the art services, such as Maintenance and hosting of genetically modified lines; Generation of new genetic lines and technologies; Assisted Reproduction Services; Generation of germ-free mice and Gnotobiology; Continuous education and certification in animal research and technology.

NATIONAL ALLIANCE OF 6 RESEARCH INSTITUTIONS IN LISBON AND OEIRAS

COLife COORDINATOR:
Mariana Silva

COLife WEBSITE:
https://colife.eu/en/

The IGC is part of COLife, an alliance of six research institutes in life sciences located in Lisbon and Oeiras: CEDOC-NMS, Fundação Champalimaud, iBET, iMM, ITQB NOVA and IGC, with a mission to promote and strengthen research in life sciences, training, innovation and connection with society, in the region of Oeiras and Lisbon.

COLife main goals are focused on the maximization of resources and potential, in terms of research facilities, scientific services and scientific expertise, by sharing infrastructures and know-how in addition to fostering synergies and collaboration between its six research institutes. With a joint communication strategy, the alliance aims to enhance the national and international visibility of the six research institutes of this alliance. COLife will be contributing to the dissemination of scientific knowledge not only to the scientific community, but also to funding agencies, industry, as well as the civil society. COLife also aims to actively participate in the development and implementation of national and European Science Policies.

In 2020, during the beginning of the pandemic and one year after the first COLife meeting at the Calouste Gulbenkian Foundation, in Lisbon, the alliance website was launched with the goal of sharing credible information initially about the COVID-19 pandemic (and long term about the research and technology happening at COLife institutes). Aiming to share information in a dynamic, useful and accessible way for both scientists and the general public. At the beginning of the pandemic, a COLife social media campaign was launched to provide reliable and accessible scientific information and tools on how to cope with the pandemic situation. COLife organized a number of scientific webinars and launched the COLife community webinar series, that aims in bringing the COLife community together and in presenting the facilities, know-how and services existent at each institute. COLife launched their own social media networks (Facebook, Twitter and Instagram) and created a Slack communication workspace that facilitates communication among the six different institutes: colife-pt.slack.com.

Bringing Science to Society

BRINGING **SCIENCE TO SOCIETY**

35
PRESS RELEASES
2020

902
NEWS ON MEDIA
(+39%/2019)

9 **EDITORIAL ILLUSTRATIONS**

6 **PUBLISHED IN MEDIA**

2 **JOURNAL COVERS**

10 **COVID INFOGRAPHICS**

LinkedIN:
+94% followers (22198)

Twitter:
+30% followers (8052)

Facebook:
+8% followers (42086)

Instagram:
started in 2020 (989)

WEBSITE
+ 400.000 page views

PUBLIC ENGAGEMENT

The public engagemet unit goal is to bring ordinary citizens closer to science through innovative approaches, and to promote a more critical, collaborative and participatory society through science. IGC promotes science communication activities aimed at diverse audiences and stakeholders, that include educational initiatives with schools and public events. The public engagement programme at the IGC was adjusted to cope with the COVID-19 pandemic restrictions. Hence, face-to-face activities were replaced by digital initiatives. Our educational activities reached 23 teachers and 583 students, and we produced 9 multimedia resources that received more than 14500 views. During 2020 we organized 11 digital events, reaching over 72500 people. Within these events we highlight the IGC Virtual Open Day that offered visitors a virtual tour of the IGC, using 360º video technology, with science riddles to unravel.

The online conference cycle Variable new world explored the connection between science and society as a fundamental tool to overcome the COVID19 crisis and to build a new reality. A new video series entitled "Cientistas em casa" (scientists at home) was created to encourage children to do science hands-on activities at home; one of the episodes addressed how to wash hands.

PRIZES

- Prémio Acesso Cultura – Linguagem Clara 2020, awarded by Acesso Cultura

EVENTS ORGANIZED 2020

- COLife webinars:
Sharing information together (series of 4 webinars; organized together with COLife partners. Target audience: general public)

- Variable New World (cycle of 3 online conferences; organized together with Ciência + Cidadã Programme. Target audience: general public)

Courses
- Inspirar Ciência - Bioinformática (target audience: high school biology teachers)

Public Events
- Music and Science at the Gulbenkian Foundation; IGC Virtual Open Day; European Researchers Night (participation in this event); Science and Technology week (participation in this event)

CITIZEN SCIENCE PROGRAM

People involved in activities

30 / **CITIZENS**

19 / **STUDENTS**

40 / **INTERNATIONAL TEACHERS**
(online workshop at TCCF conference)

23 / **PORTUGUESE TEACHERS**
(online workshop at LPN)

Partners: **ITQB NOVA and Oeiras Municipality**
Collaborators **(Carbon Tree project): INOVLabs and Escola Secundária Sebastião e Silva, Oeiras**

Ciência + Cidadã program's mission is to promote science as the starting point for well-informed and participative citizens, who become change makers in their communities, towards a more healthy, sustainable and resilient future. It aims to do this by nurturing (i) an open dialogue between citizens, scientists and political representatives, through citizen assemblies and other participatory initiatives; (ii) an active citizenship, through citizen science projects that engage citizens in the discovery of the science in their municipality and in the protection and preservation of its natural resources and biological heritage.

/ Activities developed in 2020:

- **First deliberative citizen forum on science and society**
- **Carbon Tree, the program's first citizen science project**
- **Teacher Workshops on Carbon Tree project at the Liga de proteção da Natureza (LPN) and at the Teacher's Climate Change Forum (TCCF 2020)**
- **Conference Variable New World**

/ HIGHLIGHTS IN 2020

The first deliberative citizen forum with a focus on bridging the gap between science and society took place february 8th-9th at Palácio Marquês de Pombal in Oeiras. Citizens, selected in a way to be representative of Oeiras' population, deliberated on "How to make science more accessible to citizens?" and "How to involve the citizens of Oeiras in science?". The proposals developed in the two days were presented by the citizen participants to IGC's director Dr. Mónica Bettencourt-Dias, ITQB NOVA's diretor Dr. Cláudio Soares and City Councilor Dr. Pedro Patacho.

LAB IN A BOX

Release and delivery of the new "Lab in a Box" Kits to Oeiras schools.

Number of people involved:
(school, teachers, students, partners, etc)

15 / **SCHOOLS**

20 / **TEACHERS**

700 / **STUDENTS**

6 / **PARTNERS**

Developed by scientists and science communicators from the Instituto Gulbenkian de Ciência, Lab in a Box is a pioneering pedagogical project, designed to develop students' fascination with their environment, their critical thinking skills and their scientific curiosity. Focusing on making the teaching of experimental science and the scientific method a common practice, it aims to foster the creation of a community of future "citizen scientists" in Portugal and PALOP (Portuguese-speaking African countries). With this objective, Lab in a Box develops, produces and implements in school communities of different Portuguese-speaking countries and regions, an educational kit of scientific experiments – the "Lab in a Box" kit – that is portable and modular, with simple, appealing and curriculum-integrated experimental protocols, made with low cost materials of everyday use. The project also includes and strongly invests in accredited teacher training, classroom follow-up and online resources for teachers and a constant sharing of experiences between teachers and the Lab in a Box scientists.

/ HIGHLIGHTS IN 2020

- **New "Lab in a Box" Online Platform (website)**
- **Development, production and distribution of the new "Lab in a Box - Oeiras" kits**
- **1st "Lab in a Box" accredited Teacher Training Workshops for Oeiras' primary school teachers (Estudo do Meio)**
- **1st "Lab in a Box" accredited Teacher Training Workshops for Oeiras' middle school teachers (Natural Sciences)**

COORDINATION
/ Ana Morais

EDITORS
/ Joana Carvalho
/ Joana Saraiva

LAYOUT AND DESIGN
SMASH CREATIVE AGENCY
www.smash.pt

Twitter - **@IGCiencia**
Instagram **- @igciencia**
Facebook - **@InstitutoGulbenkianCiencia**
Linkedin - **Instituto Gulbenkian de Ciencia**

All the information available on the report was shared by the Researchers, facilities and services heads who we are thankfull for the help.

The Instituto Gulbenkian de Ciência (IGC) Annual Report is available to download from the IGC website at:

GULBENKIAN.PT/CIENCIA

FOR ANY ENQUIRIES, PLEASE CONTACT:
Institutional Communication
Instituto Gulbenkian de Ciência

T: +351 214 407 913
F: +351 214 407 970
E: icomm@igc.gulbenkian.pt

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"Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less."

MARIE CURIE

GULBENKIAN.PT/CIENCIA