Annual Report 2020

SARS-CoV-2
Control sample

IGTP
Instituto de Biomedicina de赠s de las Islas Canarias
Content
Annual Report 2020

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Introduction

2020 will be known as the year when the SARS-CoV-2 virus caused a global pandemic for which the full effects on health, healthcare and research are still to be seen in the years to come. At the IGTP it was also a year of transition, with Dr Manel Puig stepping down as Director after seven years to concentrate on his research and medical work and Dr Jordi Barretina taking up the position in September. The complexity of running a very diverse biomedical research centre during a global pandemic meant that, for part of the year, the two directors were working closely together, along with the Scientific Director Julia García-Prado, to guarantee the smooth running of new consortia, approve project proposals for new COVID-19 calls and provide support to the hospital, especially with PCR testing, while continually updating the protocols to guarantee the staff safety. At the start of the second quarter of the year, the institute had rapidly transformed to accommodate online working from home and the location of the campus meant that many staff needed special permits to travel outside their municipality to work during the period of emergency.

Despite the disruption to laboratories and research groups, the IGTP still managed to increase its scientific output and also followed the general trend of open data access to get research data on SARS-CoV-2 out to the rest of the scientific community. Almost exactly the same number of projects were applied for as in 2019 and the same number were obtained. Meanwhile the number of evaluated, granted and ongoing clinical trials all increased, with IGTP researchers leading and participating in many COVID-19 trials.

Finally, it should be noted that two important strategic projects of IGTP showed their value and ability to adapt immediately to a new challenge. A new infrastructure, the Centre for Comparative Medicine and Bioimaging (IGTP-CMCiB), was essential for validating prototype ventilators, needed for overloaded hospital intensive care units, and also to advance preclinical research of novel vaccine prototypes for COVID-19. Additionally, the computational modelling group based at the IGTP-CMCiB, switched to mapping the spread of the pandemic and coordinated with the Director General for Digital Excellence and Science Infrastructure of the European Commission. At the same time, the GCAT|Genomes for Life Cohort joined national and international efforts to mine data and drill down into risk factors for contracting COVID-19 and developing severe disease, participating in important publications early in the pandemic.

A word from the out-going Director

To say that 2020 has been an exceptional year is an understatement, it has been a year that no one will forget due to the COVID-19 pandemic caused by the SARS-CoV-2 virus. I would like to highlight the fact that our medical staff and researchers have stepped up to the challenge and carried out vital work and research, getting both internal and external recognition in the process.

The year passed in a flash, but it was intense and produces conflicting emotions. We faced many crises, the most dramatic of which was probably the “ventilator crisis”. In early April ventilators were in short supply everywhere, including at our hospital, but none of our patients went without. There were initiatives all over Spain, but in Catalonia activity was feverish; in coordination with the IDIBAPS Respiratory Physiology Laboratory, we validated a total of eight different prototypes of emergency ventilators at the CMCiB in collaboration with the ICUs of our hospital and the Hospital Clinic de Barcelona. We were able to verify efficacy and safety at the clinical level, while in parallel and in continuous communication with the AEMPS, we prepared all the necessary documentation for the regulatory agency. Additionally, the IGTP and IrsiCaixa participated intensely in research projects and clinical trials of COVID-19 therapies and vaccines, which has placed us at the forefront as a center of reference, not only in Spain, but also internationally. I can only thank all the researchers and support staff, especially those of the IGTP-CMCiB and all staff members and researchers at the IGTP and the Germans Trias i Pujol Hospital, but also the hospital staff who managed an exponential rise in diagnostic PCRs within weeks.

Manel Puig Domingo, MD, PhD
Professor and Head of Endocrinology and Nutrition service
Germans Trias i Pujol Hospital and Research Institute (IGTP)
Universitat Autònoma de Barcelona
2020 has been uniquely marked by the global pandemic of COVID-19. This has affected everyone profoundly, changing working patterns and bringing in new research lines and innovations to meet new needs. Our staff were affected in their personal, family and working lives, some of them developing COVID-19 before the vaccination campaign started.

The rapid reaction of the European Commission and other funding bodies meant that many IGTP projects got rapidly underway, existing IGTP projects included re-purposing of drugs, validation of diagnostic tests, vaccine trials, mathematical modelling of infection rates, epidemiological studies and important contributions from the GCACT Genomes for Life Project and the IGTP Centre for Comparative Medicine and Bioma-ge (IGTP-CMCiB).

Despite the restrictions of movement, the institute continued with other projects and activities. Just to highlight a couple of things from last quarter of the year: in October, the spin-off company Time is Brain was created to develop a medical device to improve the diagnostics and prognostics of acute ischaemic stroke. Also, after signing the Commitment Charter to Gender Equality in Research - Hypatia of Alexandria - promoted by the Catalan Agency for Health Quality and Evaluation (AQuAS) - in January, our own Equality Committee completed the diagnostic and preparation phases of the new Gender Equality Plan at the end of the year, in line with our strong policy on equality issues. Finally, I would highlight the election of Julia García-Prado to the Scientific Advisory Board of EATRIS Spain. This is recognition of all the work the institution has been carrying out to strengthen its technological infrastructures and reinforces its presence in national and European networks.

Jordi Barretina Ginesta, PhD
General Director
Germans Trias i Pujol Research Institute (IGTP)

Even researchers like myself who have dedicated a lifetime career to viruses that can potentially cause epidemics were not prepared for the impact of the COVID-19 global pandemic in 2020. It affected scientists immediately and caused tremendous disruption in our everyday lives in the same way as it did for everyone, but it has also profoundly changed how we do our research and will continue to change it for some time to come.

In the words of a colleague, 2020 has been the year that epidemiology and public health came out of the closet; suddenly the public were anxious to hear the experts’ opinions, and concepts like the R number, herd immunity, PCR and exponential curve became part of everyday language.

Despite the speed that the virus spread, governments and institutions in Europe were slow to react and timid in their first preventive measures. The need for European and global protocols in the face of pandemics became tragically clear. Despite this, the work carried on for years, often underfunded and certainly not championed, meant that vaccine platforms were available to be adapted to the SARS-CoV-2 virus in record time. RNA vaccines were catapulted into use, changing our concept of weapons against infectious disease forever. Other technologies that have been developed, such as mathematical modelling, showed their true value and strategic projects that have taken our institute years to bring into being were able to apply the power of technology and big data to COVID-19 research.

The virus showed the need for continued investment in public health and the health system. It also sped up the adoption of digital technology in the workplace and as well as in the health services. The need for better planning and coordination for health care professional, researchers and industry became clear to overcome the emergency situation. Many things will never be the same again.

On our campus, the IGTP showed its strength in many vital areas such as vaccine development, clinical trials, high technology infrastructure and experience in large cohorts and big data. As an institute that includes primary healthcare, basic, translational and clinical research and has strong ties with companies, many of these concepts were brought into sharp focus. It was the hardest year many of us had ever lived through but it strengthened our resolve to carry out research efficiently for the benefit of society and showed us the power of a coordinated networked research system.

Julia García-Prado, PhD
Scientific Director
Germans Trias i Pujol Research Institute (IGTP)
Group Leader IrsiCaixa, AIDS Research Institute
RESEARCH AREAS
9

RESEARCH GROUPS
36

Program for Predictive and Personalized Medicine of Cancer (PMPPC)
Publications

Annual Report 2020
4865.14
IMPACT FACTOR

5.14
AVERAGE IF

946
PUBLICATIONS

Evolution

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<table>
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<tr>
<td>2019</td>
<td>4592.286</td>
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<tr>
<td>2020</td>
<td>4865.14</td>
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</table>
**IGTP Contracted Staff**

- **Women:** 203 (68.6%)
- **Men:** 93 (31.4%)

**IGTP Staff by Professional Categories**

- Researchers: 63 Men, 116 Women
- Techicians and Core Facilities: 32 Men, 42 Women
- Support and Management Staff: 19 Men, 24 Women

**IGTP Affiliated Researchers on the Campus**

- **Total Researchers:** 629
  - **Men:** 264
  - **Women:** 365

**Total Researchers by Institution**

- IGTP: 63 Men, 32 Women
- FLSIDA: 22 Men, 9 Women
- GUTTMANN: 11 Men, 12 Women
- HUGTIP: 115 Men, 99 Women
- ICO: 39 Men, 18 Women
- IDIAP: 4 Men, 1 Woman
- IJC: 79 Men, 72 Women
- IRSICAIXA: 32 Men, 21 Women
PROJECTS 2020

- **NEW NATIONAL PROJECTS**: 32
- **ACTIVE NATIONAL PROJECTS**: 236
- **ACTIVE INTERNATIONAL PROJECTS**: 34
- **NEW INTERNATIONAL PROJECTS**: 9

NETWORKS

- **5** Spanish Biomedical Research Network (CIBER)
- **16** SCR Groups Recognized by the Government of Catalonia
## INNOVATION REQUESTS

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<tr>
<th>TOTAL ACTIVE PATIENT (FAMILIES)</th>
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<tr>
<td>TOTAL SPINOFFS NEW SPINOFFS</td>
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<td>1</td>
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<tr>
<td>NEW LICENSES</td>
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**Innovation Requests: 9**

- Total Active Patients (Families): 34
- Total Licenses: 20
- New Licenses: 2
- New Spinoffs: 1
- Total Spinoffs: 9
627 ONGOING CLINICAL TRIALS

182 CLINICAL TRIALS EVALUATED BY HUMAN ETHICAL COMMITTEE

162 CLINICAL TRIALS GRANTED
Core Facilities
451 TOTAL PROJECTS

BIOBANK / TUMOUR BANK

Projects

- External: 12
- Can Ruti Campus: 53
- Total: 65

Samples

- COVID-19 stored samples: 31,569
- Total: 202,058
- Can Ruti Campus: 53
- Stored samples: 202,058

- 3,849 samples. Obtention of haematological derivatives (blood, serum, etc)
- 953 samples. Obtention of other biological fluids (urine, stool, breast milk, etc)
- 189 samples. Obtention of nucleic acids
- 1,185 samples. Obtention and preservation of tissue samples (frozen, paraffin, etc)
- 39,102 Sections. Carrying out tissue section cutting
- 790 Stainings. Carrying out staining

CRYO BIOLOGY

- Total Projects: 66
- Can Ruti Campus: 62
- External: 4

- Total Stored Samples: 1,475,000
- Can Ruti Campus: 62

- Cryovials 2mL (liquid nitrogen): 278,000
- Cryovials 2mL (-80°C): 1,197,000

- Covid projects*: 2
- Protein profiles: 24%
- Protein quantification: 244%
- Metabolite profiles: 167%
- Metabolite quantification: 500%
HIGH CONTENT GENOMICS AND BIOINFORMATICS

Projects

- External: 9
- Can Ruti Campus: 20
- Total: 29

Services by type

- Consultations on experimental design and quality control for samples and data: 37
- Processing and scanning of methylation and genotyping arrays: 34
- Obtention of nucleic acids: 9
- Bioinformatics analysis of sequencing data, micro-arrays, qPCR and multi-omics: 7
- Tailored integration of data and statistical analysis: 12

MICROSCOPY

Projects

- External: 2
- Can Ruti Campus: 18
- Total: 20

Projects by type (hours)

- Optical microscopy: 140
- Confocal microscopy: 353
- Cryostat: 431
- Microscopy with CO2 temperature: 45
**PROTEOMICS AND METABOLISM**

Projects
- External: 5
- Can Ruti Campus: 7
- Total: 12

Services by type
- Protein profiles: 24%
- Metabolite profiles: 167%
- Protein quantification: 244%
- Metabolite quantification: 500%

**TRANSLATIONAL GENOMICS**

Projects
- External: 7
- Can Ruti Campus: 35
- Total: 42

Number of samples processed and services offered
- NGS sequencing runs: 89
- NGS Library preparation: 500
- Nucleic acid extractions: 680
- Quantification and QC of nucleic acids: 6,180
- Sample pooling: 660
- Capillary electrophoresis: 8,500
UPIC – CLINICAL TRIALS UNIT

No. of patients
- Total patients 891
- New patients 757

No. of studies
- New studies 32
- Total studies 49

Studies
- Independent 24
- Industry 25

Patients
- Independent 592
- Industry 299

Visits
- Independent 1309
- Industry 530

SCReN projects
- Multicentric 6
- Coordinated 3
CMCiB – COMPARATIVE MEDICINE AND BIOIMAGE CENTRE OF CATALONIA

Projects

31
AUTHORIZED BY ANIMAL ETHICS COMMITTEE

100
TOTAL ACTIVE PROJECTS

PROJECTS FROM 18 RESEARCH AREAS

- Immunology
- Oncology
- Endocrinology
- Digestive
- Neurogenetics
- Oncology and hemathology
- Microbiology
- Pneumology
- Cardiology
- Nefrology
- Neurobiology
- Regenerative Medicine
- General and Digestive Surgery
- Laparoscopic Surgery
- Robotic Surgery
- Prosthesis
- Traumatology
- Biosensorics

127
users

21
collaborations with research institutes and companies

55
research groups working in the CMCiB
Funding Sources
IGTP · Institut de Recerca Germans Trias i Pujol

Annual Report 2020

Total Income: 12,428,169.70€

- Private incomes: 7,982,009.52€
- Calls for Funding: 12,428,169.70€
- Private funding: 2,456,885.00€
- Donations: 285,688.79€
- Generalitat de Catalunya: 2,598,352.00€
- Core facilities: 1,210,532.00€
- Financial income: 375,952.00€
- Rental income: 45,019.80€
- Capital grant Generalitat: 375,952.00€
Research Groups Summary

Area 1 - Cancer
  Badalona·Applied Research Group in Oncology (B·ARGO - ICO Badalona)
  Hereditary Cancer
  Endocrine Tumours
  Epigenetic Mechanisms in Cancer and Cell Differentiation
  Cancer Genetics and Epigenetics
  Resistance, chemotherapy and predictive biomarkers
  Childhood Liver Oncology Group (C·LOG)
  Molecular and Structural Pathology
  Clinical Genomics Research

Area 2 - Cardiovascular Disease
  Heart Failure and Cardiac Regeneration Research Program

Area 3 - Community Health
  CEEISCAT - Centre for Epidemiological Studies of Sexually Transmitted Disease and AIDS in Catalonia

Area 4 - Diseases of the Liver and Digestive Tract
  Digestive Inflammatory and Pathology Group
  Innate Immunity
  Neurogastroenterology and Motility Research Group
  Translational Research on Hepatic Diseases

Area 5 - Endocrine and Diseases of the Metabolism, Bones and Kidneys
  Endocrine Thyroid and Obesity
  Diabetes Research
  Obesity and Type 2 Diabetes: Adipose Tissue Biology
  Kidney-affecting Diseases Research Group
  Innovation in Vesicles & Cells for Application in Therapy (IVECAT)

Area 6 - Immunology and Inflammation
  Immunology of Diabetes
  Immunopathology

Area 7 - Infectious Diseases
  Clinical and Experimental Microbiology
  Experimental Tuberculosis Unit (UTE)
  Innovation in Respiratory Infections and Tuberculosis (One and a Half Lab)
  Clinical Virology and New Diagnostic Tools
  Clinical and Environmental Infectious Diseases Study Group (CEID)
  Plasmodium vivax and Exosome Research Group (PvREX)

Area 8 - Neuroscience
  Vascular Pathologies of the Brain
  Cellular and Molecular Neurobiology Research Group (CMN Group)
  Neuromuscular and Neuropaediatric Research
  Neurogenetics
  Genomics and Transcriptomics of Synucleinopathies (GTS)
  Psychoneuroendocrinology and Stress in Psychosis (PSICPNEC)

Area 9 - Science of Behaviour and Substance Abuse
  Medical Complications of Substance Use Disorder (GIAS)
  Clinical Pharmacology of Substance Use Disorder
Group: Badalona·Applied Research Group in Oncology (B·ARGO – ICO Badalona)

Group Leader: Ricard Mesía Nin
Scientific Coordinator: Anna Martinez Cardús, amartinezc@igtp.cat

Research Overview

B·ARGO is a recent transversal organization of the translational and clinical research that has been carried out for many years at the IGTP, the Germans Trias University Hospital and the Catalan Institute of Oncology Badalona located at the hospital. The group consists of senior researchers, junior researchers and fellows from the IGTP and personnel of the Medical Oncology Department of the ICO who are affiliated to the IGTP. The multidisciplinary group is made up of over 30 professionals working on the different aspects of research. The mission of the B·ARGO is to be a translational research group of excellence that contributes to the application of personalized oncology. The vision of the B·ARGO is to maintain an integrated cancer research and healthcare system that optimizes the management of cancer patients and improves the length and quality of their lives.

The general aims of the B·ARGO are:
• To fill the existing gap between clinical and basic cancer research
• To identify new strategies, emerging from basic research and apply them in clinical practice
• To typify new biomarkers for cancer diagnosis and prognosis
• To identify new predictive biomarkers of response to current anti-neoplastic therapies
• To determine biomarkers for tumor resistance acquisition during exposure to treatment

Group Highlights 2020

• Human Resources: 2 Rio Hortega grants and 1 Juan Rodés grant from the Instituto de Salud Carlos III advancing the milestone of establishing a mixed research program, based on clinical healthcare, combined with translational research activity in the laboratory.
• Competitive Research Projects: 2 grants from the Sociedad Española de Oncología (SEOM) and another from ISCIII permitting planning of stable research lines
• Research: Participation in several national collaborative projects and contributions to transversal research programs at other ICO centers and the institutes

Selected publications 2020


Group: Hereditary Cancer

Research Overview
Neurofibromatosis type 1 (NFI) is a genetic disease with an incidence at birth of 1:3000. NFI1 individuals present a high predisposition to develop multiple tumors of the peripheral nervous system. These tumors are the main cause of morbidity, have a high impact on their quality of life and, in the case of malignant soft tissue sarcomas, represent the main cause of mortality. Clinical management of NFI patients with high tumor burden is complex.

Our research is based in the generation of in vitro/in vivo cell-based model systems for these tumor types, such as the use of induced pluripotent stem cells (iPSC) in combination with editing tools and the generation of 3D model systems. We apply genomics and integrative bioinformatic analyses to both tumors and models, with a translational view. We seek a better understanding of tumor initiation, progression and cellular composition, and to understand the impact of tumor heterogeneity on treatment response. We also aim to develop better surveillance tools for monitoring tumor initiation and progression and for an accurate differential diagnosis. In addition, our research centres on the development of more effective therapeutic strategies.

Group Highlights 2020

New projects awarded:
- Impacto de la heterogeneidad celular, genética y epigenética en la progresión y el tratamiento de los tumores del sistema nervioso periférico asociados a la neurofibromatosis tipo 1; Instituto de Salud Carlos III, PIs: Bernat Gel, Eduard Serra
- NFI1-Associated Peripheral Nerve Sheath Tumors at Single-Cell Resolution: Heterogeneity, Tumor Growth, and Malignant Progression; DOD-Congressionally Directed Medical Research Programs (CDMRP), USA; PI: Eduard Serra


Selected publications 2020

Group: Endocrine Tumours

Research Overview
The group seeks to better understand the molecular landscape of thyroid cancer and pituitary tumours. The aim is to characterize mechanisms of progression and response/resistance to treatments to advance biomarker and drug target discovery with the final goal of helping treatment decision making and improve patient outcomes. There are 2 main research lines:

1. Thyroid cancer. The majority of patients have an excellent prognosis; however, a subset of carcinomas progress and there are no effective biomarkers available. The group is investigating the molecular basis of aggressive thyroid cancer, with special focus on epigenetics, to identify prognostic and predictive markers, and potential therapeutic targets. The team is especially interested in kallikreins, a family of 15 secreted serine proteases, which they found to be deregulated in thyroid cancer. They are currently assessing their clinical utility and functional implications in the disease.
2. Pituitary adenomas. The group investigates the pathogenesis of pituitary tumours in collaboration with the Endocrinology Service at the Germans Trias i Pujol University Hospital led by Dr. Manel Puig. The team combines clinical, pathological and molecular information to identify prognostic markers, predictors of response and new therapeutic strategies that allow the shift towards personalized medicine.

Group Highlights 2020

• Joan Gil obtained his PhD from the Autonomous University of Barcelona
• Juan Carlos Pardo, was awarded a Rio Hortega fellowship (CM20/00028) to work in our lab
• Lorena González joined the laboratory as a technician
• The group established and validated an epigenetic assay based on an algorithm they had previously generated to predict the development of distant metastases in thyroid cancer
• Consolidation of the research line on radiolabeled radioactive thyroid cancer

Selected publications 2020

**Group: Epigenetic Mechanisms in Cancer and Cell Differentiation**

**Group Leader:** MA Peinado, mpeinado@igtp.cat

**Research Overview**

The main focus of the group’s research is the characterization of the molecular mechanisms underlying cell programs and the identification of molecular markers with clinical applications. The specific topics under development in the laboratory include:

- Chromatin architecture in cell differentiation and cancer (MA Peinado)
- The role of repeat elements in genome structure and function (MA Peinado).
- Clinically oriented research on the epigenetic changes involved in human cancer (MA Peinado)
- Genomic Medicine Technological Innovation (MA Peinado)
- Epigenetic changes in muscle pathologies (M Suelves)
- Deciphering the role of HDAC11 in skeletal muscle (M Suelves)

**Selected publications 2020**


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**Group: Cancer Genetics and Epigenetics**

**Group Leader:** Sergio Alonso, salonsou@igtp.cat

**Research Overview**

2020 was dramatically marked by the closure of the laboratory due to the covid-19 pandemic. The group is mainly experimental and, adding this to the small size of the group, the closure forced a complete halt to research for over three months. The abrupt interruption of three master’s theses and the experiments that required finishing to complete very advanced studies meant that these were finally submitted in 2021. (now in revision in Genome Research and in Clinical Cancer Research, respectively). Despite the extremely unfavourable circumstances, the three students successfully defended their master’s theses in October and November.

The group led the formation of a multi-disciplinary team of IGTP researchers to apply for funding from the Fundación Mutua Madrileña, to explore the association between alterations in genes coding for extracellular matrix remodelers and lymphocytic infiltration. This funding has been awarded.

The group has strengthened collaboration with Professor P. Zavattari’s group at the University of Cagliari. The team applied for a European project and for a Mark Foundation for Cancer Research project to study epigenetic markers for early detection of biliary tract cancers.

**Group Highlights 2020**

Funding from the Fundación Mutua Madrileña to study the relationship between remodelling of the extracellular matrix with lymphocytic infiltration and explore their use as predictive biomarkers, or as future therapeutic targets to improve the response to immunotherapy for colorectal cancer.
Group: Resistance, chemotherapy and predictive biomarkers
Group Leader: Eva Martínez Balibrea, embalibrea@iconcologia.net

Research Overview
In 2020 we kept on working on projects PI16/01800 and PI16/00011 that are focused on the study of CXC chemokines and their role as biomarkers in colorectal cancer (CRC) and on the discovery of chromatin regulators that could be used as new biomarkers and drug targets, also in CRC, respectively. We started to implement a new technique in our lab called MDOTS and PDOTS consisting of growing tumors ex vivo and test immunotherapy (and other) treatments. The project has been funded by Merck. We have also started a new research line in collaboration with Dr. Balañà from ICO Badalona in which we will study the role of proteins UBXN7 and ZNF7 in glioblastomas. We have published a review article about curcumin as possible therapy in CRC in the journal Seminars in cancer biology. In 2020 we have published a review article Curcumin: A therapeutic strategy for colorectal cancer? (PMID: 32942023)

Group Highlights 2020
- Publications
  The paper Curcumin: A therapeutic strategy for colorectal cancer? (PMID: 32942023)
- Projects
  » Funding for Eva Martínez-Balibrea as PI on an Ideas SEMILLA project from the Asociación Española contra el Cáncer (AECC)
  » Funding as collaborators on the Fundación Mutua Madrileña project led by Sergio Alonso Utrilla
  » Funding as part of the INSPECTA Project (Merck) led by Cinta Hierro
- Establishment of a new research line Research in glioblastoma: Implementation of MDOTS/PDOTS ex vivo models (in collaboration with David Barbie – Dana Farber Cancer Institute, Boston)

Selected publications 2020

Group: Childhood Liver Oncology Group (C–LOG)
Group Leader: Carolina Armengol, carmengol@igtp.cat

Research Overview
The main goals of this pioneering group focusing on translational research of paediatric liver cancer in Spain are to increase the molecular knowledge of hepatoblastoma. Although it is the main liver cancer in children, it is extremely rare and the group aims to identify biomarkers and therapeutic targets to improve quality of life and survival of patients with primary liver cancer, including hepatocellular carcinoma.

Another objective is to boost translational research into childhood liver cancer. In 2010 the group was responsible for creating the first national collection of biospecimens from patients with liver cancer (ISCIII National Biobank Registry, collection section, ref. C.0000226), called CLCN. The collection also includes samples from adult patients with liver cancer thanks to the group’s participation in the international Paediatric Hepatic International Tumour Trial (PHITT). The CLCN collection is the basis of our 3 main research lines:
1. Understanding the molecular biology of childhood liver cancer using the latest high-throughput technologies and computational tools.
2. Identification and validation of diagnostic and prognostic biomarkers to improve the clinical management of childhood liver cancer using samples of the EU PHITT cohort.
3. Establishing new experimental patient-derived models of childhood liver cancer (i.e. PDXs, organoids) to test innovative therapies against tumor cells.

Group Highlights 2020
- Scientific milestones
  » Establishment of one of the largest collections of clinical and pathological annotated biological samples from childhood liver cancer patients worldwide
  » Exhaustive omics characterization led to the discovery that RNA editing and 14q32 DLK1/DIO3 cluster of genes are dysregulated in hepatoblastoma and the definition of a first Molecular Risk Stratification of hepatoblastoma.
- New research line established
- Extensive communication and popularization of science activities
- Publication of an illustrated children’s book for children with liver cancer

Selected publications 2020
Research Overview

The group is mostly dedicated to research on biomarkers and molecular mechanisms underlying the development and progression of malignant neoplasms and aims to provide translational knowledge to advance the diagnosis, prognosis and prediction of a variety of human cancers. For this purpose, the team combines both morphological (light and ultrastructural microscopy) and advanced molecular tools including next generations sequencing (NGS), situ hybridization and immunohistochemistry and these are integrated with bioinformatics tools such as digital pathology to provide a multidisciplinary approach to cancer research. The group also has a special interest and long and productive research tradition in non-neoplastic conditions, including dermatopathology and nephropathology amongst others. The Molecular and Structural Pathology Group has been repeatedly recognized as a Consolidated Research Group (2017SGR639) by the Agency for Management of University and Research Grants (AGAUR) of the Government of Catalonia and has the financial support of several competitive grants, including those of Instituto Carlos III and Marató de TV3.

Group Highlights 2020

The main highlight of 2020 was the start of implantation of digital pathology in the service in collaboration with the Universitat Politècnica de Catalunya (UPC).

Selected publications 2020


3. Sopathies (Castellanos et al. 2020) and is working to improve problems such as the presence of overlapping clinical manifestations and the genetic heterogeneity of these diseases. It has also improved the UK score system for Spanish patients attended in the CSUR (National Reference Centre in genetic neurocutaneous syndromes (Facomatosis)) at the hospital.

During the covid-19 pandemic, Ignacio Blanco has been leading the Multidisciplinary Unit for the Diagnosis of covid-19 in the Clinical Laboratory of the North Barcelona Metropolitan Area (LCMN). Together with the LCMN, the group has participated in the search and development of different diagnostic methods for covid-19. Ignacio Blanco has led the screening of health professionals for covid-19 (Barallat et al. 2020) and the team have participated in the identification of genetic susceptibility factors to SARS-CoV-2 (Zhang et al. 2020, Bastard et al. 2020), the study of the mechanisms of transmission through species (Segalés et al 2020) and the identification of possible treatments (Revollo et al 2020) among others.

Group Highlights 2020

Funding was secured for 2021 (PI20-00215 (AES, Instituto de Salud Carlos III); MA-RATO DE TV3 de Malalties Minoritàries (126/C/2020) and IMIM-CHM), the group’s research plan includes:

1. Expansion of capacities of the custom panel to analyse the genes associated to Phakomatoses also at the RNA level.

2. Development of new clinical tools to improve the clinical follow-up, genetic counselling and clinical management of patients with Neurofibromatosis type 2, as well as the evaluation of the impact of the disease on Quality of Life in order to establish an algorithm.

3. Participation in the evaluation of SARS-CoV-2 variants in the Catalan population to monitor them epidemiologically together with Microbiology department of HGTP, IGTP and IRSAixia (Hub de Sequiciació del Campus Can Ruti).
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Research Groups

Area 2

Cardiovascular Disease

Group: Heart Failure and Cardiac Regeneration
Research Program (ICREC Research Group)
Group Leader: Antoni Bayés Genís, abayes.germandrias@gencat.cat

Research Overview

The Program has five main coordinated research lines, it maximises synergy with the sole purpose of improving quality of life and extending life expectancy for patients.

1. Myocare Lab is focused on development and testing of innovative biotherapies using in vitro, small and large animal models.
2. ASAC, the Clinical Trials Unit, is responsible for translating validated pre-clinical results to the clinical scenario with the required approvals.
3. The Platform of Cardiovascular Precision Medicine (PMPCV) focuses on the discovery of novel cardiovascular biomarkers and expands the use of those already known.
4. The Innovation Unit gives commercial outlet to new products and devices derived from ICREC research.
5. The Cardiometabolism line has recently been created to find out the underlying molecular mechanisms of cardiometabolic diseases.

In 2020 we pioneered first-in-human studies, including the PERISCOPE trial (NCT03798353), and AGTP-II trial (NCT02798276), and we have developed and tested pre-clinically a new cardiac tissue engineering product with extracellular vesicles for myocardial repair.

Group Highlights 2020

- Development of a new advanced therapy product based on cardiac tissue engineering and multifunctional extracellular vesicles
- PeriCord: a successful collaborative research milestone in scalability and GMP manufacturing of a cardiac tissue engineering bioimplant for clinical use
- 5 competitive national projects from ISCIII, MI-CiIN, CaixaImpulse, the Generalitat de Catalunya and Societat Catalana de Cardiologia
- ICREC Program has signed a partnership with Boehringer-Ingelheim giving rise the new Creation of the Cardiometabolism Platform to address the molecular mechanisms responsible for cardiometabolic disorders
- Award for the best study at the Societat Catalana de Cardiologia Congress 2020

Selected publications 2020

Group: CEEISCAT – Centre for Epidemiological Studies of Sexually Transmitted Disease and AIDS in Catalonia

Group Leader: Jordi Casabona jcasabona@iconcologia.net

Research Overview

CEEISCAT is a structural service of the Catalan Institute of Oncology (ICO) and it is functionally directed by the Programme for the Prevention, Control and Care for HIV, Sexually Transmitted Diseases (STDs) and Viral Hepatitis (PCAV/HV) of the Ministry of Health of the Government of Catalonia.

Since 1995 CEEISCAT has been responsible for the epidemiological surveillance and monitoring and evaluation of HIV and STDs in Catalonia, and since 2018 has been responsible for monitoring and evaluating the Elimination Plan for Hepatitis C in Catalonia, within the PCAV/HV.

CEEISCAT carries out applied research projects in public health through funding from national and international agencies and from the private sector that has improved knowledge about the HIV epidemic in Catalonia, promoted the integration of community-based testing in the surveillance systems of information in Europe and piloted innovative testing strategies, among others.

Activity during 2020 has been clearly impacted by the COVID-19 pandemic. Researchers focused on the design and implementation of epidemiological studies on the impact of COVID-19 on different populations and services such as blood donating, people living with HIV, young people or community-based testing centers, among others. In the same way, CEEISCAT researchers have analyzed the impact of COVID-19 on epidemiological surveillance data in Catalonia and have collaborated with various studies on COVID-19 that have been carried out in Catalonia and especially at the Can Ruti Campus.

Selected publications 2020


Research Overview

The group is integrated into the Gastroenterology Service of the Germans Trias i Pujol University Hospital and has been well established for over 30 years. The Inflammatory Bowel Disease (IBD) Unit is a healthcare reference centre with more than 1,600 IBD patients. It has been part of the CIBEREHD Network (Centro de Investigación Biomédica en Red en Enfermedades Digestivas y Hepáticas) since 2007 and since 2017 has the Certification of Excellence as an Integral IBD Patient Care by the Ad Qualitatem Foundation.

The main lines of research of the group are: 1) characterization and treatment safety/efficacy; 2) postoperative recurrence in Crohn’s disease; and 3) Response to corticosteroids in ulcerative colitis. In translational research the group has incorporated massive genomic analysis with innovative computational analyses, as well as in vitro and in vivo genetic experimental models and molecular analysis.

Group: Digestive Inflammatory and Pathology Group

Group Leader: Eugeni Domènech

Additionally, the group have projects in innovation and business development, pending patent applications and collaborations with the pharmaceutical industry. Additionally, members of the group are very much involved in academic work, teaching and training.

Group Highlights 2020

- 3 Projects financed by Instituto de Salud Carlos III (Government of Spain) in development during 2020: ISCIII (PI20/00420); 2021-2023; IP Josep Manyé Almero, ISCIII (PI18/00892); 2019-2022; IP Dr. Miriam Mañosa Ciria and ISCIII (PI16/01937); 2017-2021; IP Eugeni Domènech Morral.
- European patent extension (P3614EP01): microRNAs as biomarkers of cortico-refractoriness in ulcerative colitis
- Young Researcher Scholarship of the Catalan Society of Digestology 2021, Roger Suau

Selected publications 2020


3. Switching to a Second Thiopurine in Adult and Elderly Patients With Inflammatory Bowel Disease: A Nationwide Study From the ENEIDA Registry. Calafat et al. ENEIDA registry of GETECCU. J Crohns Colitis 2020; 14(9):1290-1298.


Research Overview

One of the main aims of the group is to define the role of Innate Immunity proteins as prognostic or diagnostic biomarkers of disease. Another objective is to generate knowledge and develop new therapies to target Innate Immune responses. Research is mostly centered on the role of macrophages in the control of immune homeostasis and inflammatory disease. The group has 3 main lines of research:

1. Understanding macrophages as central drivers of pathology (Pi: MR Sarrías). Combining basic, translational and innovation approaches this line is mostly centered on understanding liver disease, within the CIBERehd consortium. We are developing a novel immunotherapy to target macrophages in cancer in collaboration with Dr Atheli Rodríguez (UAB). Our laboratory has been working on one of the stages of this project for the last 2 years. Additionally, we have joined efforts with Dr PJ Cardona (Clinical Experimental Microbiology) to understand trained immunity in the context of the COVID-19 pandemic.

2. Generation of novel in vitro diagnostic tests (Pi: MR Sarrías). Based on the group’s findings in biomarker studies, research continues in collaboration with a diagnostics company (Lionex, Germany), and within the context of an international consortium led by Dr Vilaplana, (UTE, SMA-TB, IGTP).

3. Novel stratification strategies that complement the current clinical criteria of cirrhosis (Pi: Helena Masnou). This new line of research started in 2020 thanks to the award of a collaborative FIS project with Dr Masnou of the Department of Gastroenterology, HUGTIP.

Group Highlights 2020

In the context of the covid-19 pandemic, we have joined forces with Dr PJ Cardona (UTE) to analyse trained immunity in the context of the SARS-CoV-2 virus. Additional funding has allowed us to incorporate 2 new post-doctoral researchers and two new pre-doctoral students into our team in addition to our technician and UAB collaborator. An important addition in 2020 was the opening of a new line of research in hepatology, made possible by the funding of a FIS project, in collaboration with Dr H Masnou (HUGTIP).

Selected publications 2020


Group: Innate Immunity
Group Leader: Maria Rosa Sarrías, mrsarrias@igt.cat

Group: Neurogastroenterology and Motility Research
Group Leader: Pere Clavé, pere.clave@ciberehd.org

Research Overview

This group is part of the Maresme Health Consortium (CdSM) based in the Mataró Hospital. It is made up of medical staff and researchers working in primary care and is recognized as a consolidated group by the Government of Catalonia (2017 SCRR772) AGAUR, and forms part of the National CIBERehd Network. The group has 4 lines of research:

1. Oropharyngeal Dysphagia: This includes compensatory strategies, rheology and texture, nutritional research and optimal-massive interventions; clinical and basic studies. Also new diagnostic and treatment strategies: screening with Artificial Intelligence algorithms, pharmacological agonists (TRP agonists), neurorehabilitation strategies. Peripherical electrical stimulation (Intrapharyngeal, Transcutaneous), non-invasive brain stimulation (NIHS, TDCs, rTMS).

2. Upper GI tract motility. GERD in Morbid Obese patients, Achalasia, Upper Esophageal Sphincter Motility

3. Colorectal Motility: This includes the study of pathophysiology, diagnosis and treatment of fecal incontinence and the development of neurorehabilitation strategies. Also, research into prevalence, pathophysiology and diagnosis of functional constipation and functional defecatory disorders.

4. Basic Studies: In vitro gastrointestinal motility

Group Highlights 2020

Together with the Mataró Town Council the group received a prestigious European Regional Development Fund grant (PEC Mata-ro-Maresme Innovation Ecosystem for Caring Cities 2021) aimed at promoting healthy aging and improving the care, autonomy and quality of life of elderly people from Mataró through: 1) promoting healthy habits and lifestyles; 2) urbanism and housing; 3) health and social aspects; and 4) research and education. One of the specific programs of this project is dedicated to oropharyngeal dysphagia in older people.

We are in the process of founding a start-up company to exploit the patent AIMS-OD (PCT/ES2020/070723) that uses artificial intelligence algorithms to predict the risk of several prevalent pathologies.

Selected publications 2020


**Group: Translational Research on Hepatic Diseases**

**Group Leader:** Rosa Mª Morillas rmorillas.germanstrias@gencat.cat

**Research Overview**

This is a multidisciplinary group led on the clinical side by Dr Rosa Mª Morillas, Head of the Hepatology Department at the Germans Trias i Pujol University Hospital and at the IGTP Dr Ramon Bartolí, Principal Investigator for Basic and Translational Research and CIBER researcher. The group focuses on clinical and translational research on chronic hepatitis, non-alcoholic fatty liver disease, cirrhosis and complications of portal hypertension (ascites, haemorrhage due to portal hypertension, hepatic encephalopathy, spontaneous bacterial peritonitis, infections) and hepatocellular carcinoma. They are also experienced in the development of different experimental models of liver disease: cirrhotic rat model with ascites -carbon tetrachloride-, hepatic encephalopathy model -cirrhosis + portal vein ligation-, secondary biliary cirrhosis model due to ligation of the common bile duct and steatohepatitis model with different degrees of fibrosis (metabolic model + carbon tetrachloride). They have developed an endoscopic platform able to release drugs and active agents in colonic tract and are studying its applicability in different liver diseases. The group is also highly networked with other groups or lead collaborative projects within organizations such as: the Societat Catalana de Digestologia (ACD), the Asociación Española para el Estudio del Higado (AEEH), the European Association for the Study of the Liver (EASL), the National network CIBerehd (the Center for Biomedical Research in Networks in Hepatic Diseases and Digestive 2006 / Area 1: Portal hypertension and mechanisms of transition to cirrhosis) and member of the working group Prevention and treatment of the complications of chronic liver disease (GTIPUH), which is part of the National Network of Research in Hepatology and Gastroenterology (RNHiG).

**Group Highlights 2020**

In May the group signed the license agreement for two patents (WO2016135219A1, WO2018019881A1), which have been developed by members of the group to the start-up Inmedical Therapeutics. A new basic-translational research line was established on the use of the platform developed by the group (COVERGEL) for the modification of the intestinal microbiota in the treatment of fatty liver with fibrosis.

**Selected publications 2020**

5. Rebleeding and mortality risk are increased by ACLF but reduced by pre-emptive TIPS. Trebicka J et al and International Variceal Bleeding Observational Study Group and Baveno Cooperation. J Hepatol 2020 Nov. 73 (5): 1082-1091. PMID: 32339602.
Research Overview

The IGTP Translational Endocrinology research group (ENDOCRUP- 2017 SGR 1262) is coordinated by Manel Puig Domingo, currently Head of the Endocrinology and Nutrition Service at the Germans Trias i Pujol Hospital (HUTIP) and Professor of Endocrinology at the UAB Department of Medicine. The group has 3 areas of research:

1. Thyroid pathology
   - The group has been working for many years on (i) the evaluation of thyroid function in relation to iodine nutrition and its consequences during pregnancy, (ii) autoimmune thyroid diseases, and (iii) thyroid cancer, specifically we are characterizing the phenotypic and molecular (comatic) aspects of thyroid tumors to discover molecular pathways likely to generate new therapeutic targets and also to identify diagnostic and prognostic markers with potential applicability to clinical practice.

2. Pituitary tumors
   - The group studies the molecular phenotyping of pituitary tumors and also researches the use of bioimaging markers for applications in personalized medicine as predictive markers of therapeutic response and biological evolution.

3. Obesity
   - Since 2010, different lines of research have been initiated to study the complications of obesity and its possible reversal after therapeutic bariatric surgery. We have also done studies focused on brown adipose tissue.

Group Highlights 2020

Despite the situation caused by the pandemic, we have validated markers of therapeutic response of pituitary adenomas by studying more than 12 different markers, establishing the importance of E-cadherin and ORC2R and initiated studies using artificial intelligence procedures, specifically radiomics and data mining. We are concluding the ACROFAST 1 clinical trial, the first study worldwide on precision medicine in acromegaly, coordinated by Can Ruti. In thyroid cancer, we continued to study kalikreins. Finally, in the field of obesity, we are concluding a study on microbiota and starting another study on the value of succinate as a predictor of response to two types of bariatric surgery. Regarding the pandemic, we have been actively involved in clinical research and guidelines.

Selected publications 2020


Group: Diabetes Research

Group Leader: Núria Alonso nalonso@igtp.cat

Research Overview

The fundamental clinical issue addressed in this area is the detection and characterization (phenotypic and molecular) of preclinical atherosclerotic cardiovascular disease in patients with diabetes (types 1 and 2). Dr N Alonso (NA) leads this line of research (PI14 / 01772, PI17 / 01362, PI 21/00817), which since 2016 has been part of CIBERDEM as a recognized group. The group is also working on the characterization of myocardial microvascular disease and metabolic toxicity associated with hyperglycemia in diabetic cardiomyopathy (DCM) (TV3 Marathon Project 201602-03, IP: NA) and on the relationship between diabet- retinopathy (DR) and cognitive dysfunction (European project RECONN2ED). Relevant findings published in recent years are: an increase in subclinical atherosclerosis in patients with diabetes in the absence of kidney disease; the description of cerebral microvascular disease associated with diabetes; the existence of myocardial microvascular disease in patients with type 2 diabetes and heart failure: diabetic cardiomyopathy may underlie functional decline. Cardiovasc Diabetol. 2020 Mar 23;19(1):38. doi: 10.1186/s12933-020-01011-w.

Selected publications 2020


The most relevant published results of the group are: 1) Description of the advanced lipo- protein profile in subjects with varying degrees of impaired glucose metabolism, 2) The HDL lipoprotein as a prognostic factor for CV dea-th in patients with chronic heart failure (CHF), 3) description of the prevalence of liver fibrosis and relationship with lipid parameters in general population and in diabetes, 4) the trajectory of the cardiac ejection fraction is different in patients with CHF in the presence of diabetes.
**Selected publications 2020**


2. Ruben Cereijo; Tania Quesada-López; Silvia Pellitero; Jordi Tarasco; Pau Solé; Manel Puig-Domingo; Jordi Bonal; David Sánchez-Infantes; Francesc Villaroy. *The chemokine CXCL14 is negatively associated with obesity and concomitant type 2 diabetes in humans. International Journal of Obesity. In press Impact factor: 4.36 (Q2)* Corresponding author, 11/2020. DOI: 10.1038/s41366-020-00732-y

3. Irene Piquer-Garcia; Ruben Cereijo; Juan Corral-Pérez; Silva Pellitero; Eva Martinez; Sri D. Taneer; Jordi Tarasco; Pau Moreno; José Balbiire; Manel Puig-Domingo; Dolores Serra; Laura Herreos; David Jiménez-Pavón; Carles Lenn; Francesc Villaroy. *Use of infrared thermography to estimate brown fat activation after a cooling protocol in patients with severe obesity that underwent bariatric surgery. Obes Surg. doi:10.1007/s11695-7, Last author and Corresponding author IF: 3.603 (Q2), 2020. DOI: 10.1007/s11695-020-04502-7

4. Silvia Ribó; David Sánchez-Infantes; Laura Martínez-Guijarro; Izaskun García-Mantrana; Marta Ramon-Krauel; Mireia Tordo; Erland Arning; Miquel Nofrarías; Óscar Ossorio-Conlés; Antonio Fernández-Pérez; Pedro González-Torres; Judith Cebrià; Alex Gavaldà-Navarro; Empar Chennollí; Elvira Isganatis; Francesc Villaroy; Maria Vallejo; Joaquim Segalés; Josep C. Jiménez-Chillaron; Teodoro Bottiglieri; Ellen W. Demerath; María Carmen Collado; David A. Fields; Carles Lenn. Increasing breast milk betaine content modulates offspring Akkermansia abundance during early life and improves long-term metabolic health. Sci Transl Med. Co-first author - In press. IF: 16.3 (D1), 2020.

5. Mindea Weber; Paula Mera; Josefa Casas; Javier Salvador; Amaia Rodriguez; Sergio Alonso; David Sebastian; M Carmen Soler-Vazquez; Carla Montironi; Sandra Recalde; Raquel Fuchs; Maria Calderón-Dominguez; Joan Francesc Mil; Ramon Bartrons; Joan Carles Escola-Call; David Sánchez-Infantes; Antoni Zurrana; Vicenta Liorente-Cortes; Nuria Carlutz; Victor Valetti; Gema Frühbeck; Laura Herrero; Dolors Serra. *Liver CPT1A gene therapy reduces diet-induced hepatic steatosis in mice and highlights potential lipid biomarkers for human NAFLD. FASEB J. IF: 5.39 (D1), 2020. DOI: 10.1096/fj.202000678R*

**Research Overview**

This research team focusses on the study of obesity and type 2 diabetes. They search for molecules secreted by white and brown adipose tissue involved in the inflammatory state that occurs during the obesity. They also evaluate the capability of these molecules to inhibit/activate the brown adipose tissue and to modulate the properties of subcutaneous white adipose tissue, which is replaced by thermogenic beige adipose tissue (browning) in obesity. The goal of this group is to decipher why the excess of fat is inhibiting the normal activation and function of brown adipose tissue and browning, and to search for novel pharmacological approaches to treat obesity and related diseases.

**Selected publications 2020**


Group: Innovation in Vesicles & Cells for Application in Therapy (IVECAT)

Group Leader: Francesc E. Borràs, feborras@igtp.cat

Research Overview

The IVECAT group is dedicated to the study of different aspects of extracellular vesicles such as exosomes and microvesicles and also of different cell types including mesenchymal stem cells. The aim is always to move basic research through the pipeline to clinical application.

The group's research interests are mainly the discovery of new biomarkers for better diagnostic and prognostic of patients and the study of novel biotherapies for immunomodulation and regeneration of affected tissues.

Although we focus on transplantation and renal related diseases, we also study EVs in cardiac repair, in neuro-degenerative diseases, and pathologies affecting other systems.

Selected publications 2020


Area 6: Immunology and Inflammation

Annual Report 2020

Research Groups

Area 5: Endocrine and diseases of the metabolism bones and kidneys
Research Overview

The multidisciplinary Immunology of Diabetes Group at the IGTP is part of the Immunology Section of the Germans Trias i Pujol University Hospital (HUGTP). It is made up of researchers, endocrinologists, paediatricians and technicians; the group works to understand more about the causes of type 1 diabetes. The research of the group is focused on translational research: Immunotherapies for the prevention and treatment of Type 1 diabetes, pathogenic mechanisms of autoimmunity and paediatric type 1 diabetes: tolerance, spontaneous resolution and biomarkers. Our goal is to contribute to therapeutic intervention in type 1 diabetes and other autoimmune diseases.

The principal investigator, Marta Vives-Pi, has been working in the field of autoimmune diseases since 1988. Since 1996 she has been leading a variety of research projects with special emphasis on the development of immunotherapies. In 2000 she started the specific pathogen free Unit (SPF) at the IGTP, designed for the study of experimental models of type 1 diabetes. M. Vives-Pi is also the co-founder and Scientific Officer of Ahead Therapeutics SL, a spin-off company set up to transfer the immunotherapy technology generated by the group to the clinical arena and convert know-how into treatments for autoimmune diseases.

Group Highlights 2020

News (Communication and popularization of science)

- 13 May Adrián Villalba on the 24 News service in Catalonia
- 29 October Marta Vives-Pi interviewed on the Hub de Salud con Rosa Quintana, a health news and information website run by the ell-known national television presenter
- 30 November, Marta Vives-Pi interviewed by the Catalan Immunology Society

Selected publications 2020


Selected publications 2020

Research Overview

This is a consolidated multidisciplinary research group accredited by the Catalan Government. Several group members belong to CibeRes (Centro de Investigación Biomédica en Red en Enfermedades Respiratorias), while some others belong to CiberEsp (Centro de Investigación Biomédica en Red en Epidemiología y Salud Pública).

The research group focuses its activity on the development, standardization and clinical evaluation of microbiological, immunological and molecular techniques susceptible for use in the diagnosis of infectious diseases and the development of “in vivo” experimental models including the Drosophila model, the study of the molecular mechanisms underlying antimicrobial resistance, the assessment of the antimicrobial activity of new antiseptic and disinfectants, and the fight against nosocomial infection through classic and molecular epidemiology tools. Molecular epidemiology throughout 2020 has been an exceptional year for the entire research community and infectious disease research in particular. Research and healthcare has seen an unprecedented readjustment of activity to focus on diagnostics, treatment and prevention during the SARS-CoV-2 epidemic.

Selected publications 2020


Research Overview

The Experimental Tuberculosis Unit (UTE) is a research group at the IGTP also affiliated with the Department of Microbiology at the Germans Trias i Pujol University Hospital (HUTIP) and the Departments of Genetics and Microbiology at the Universitat Autònoma de Barcelona. The group was founded in 1997 by Dr Pere-Joan Cardona to study tuberculosis (TB) and is now led by Dr Cris Vilaplana. In recent years the unit has specialized in the field of design and evaluation of new prophylactic and therapeutic strategies against TB and tools to monitor its course, as well as the study of the disease from a multidisciplinary point of view from bench to bedside. With its 20-years’ experience the group are recognized internationally as experts in the field of infectious diseases.

The UTE has 3 main research lines:
1. Study of biomarkers of TB disease course and prognosis
2. Evaluation of new prophylactic and therapeutic strategies against TB in:
   - experimental models of infection
   - clinical studies and trials
3. Study of Health dimensions and quality of life in the context of infectious diseases

Selected publications 2020


Group Highlights 2020

- Start of the SMA-TB, a multicentric project funded by the EC through the H2020 program and coordinated by UTE
- Participation in several projects to tackle the covid-19 pandemic, including an international one funded by the 2020-EC
- 12 scientific manuscripts published in international journals
Research Overview

The group promotes multidisciplinary translational research to improve the diagnostics, prognostics and management of infections caused by viruses and other pathogens with impacts on clinical applications and public health. Based in the Microbiology Service and the Clinical Laboratory, it is part of the General Directorate of Public Health (Area 7) within the Epidemiology and Public Health). It has three main research lines.

1. Viral hepatitis. Characterization of the molecular epidemiology of HCV (dynamics in key populations, such as people who inject drugs and people in prisons). 2) Improvement of the diagnosis of active HBV and HCV infection among vulnerable populations. 3) Assessment of HBV prevalence and vaccination needs in vulnerable populations.

2. SARS-CoV-2. Within the SeqCOVID-Spain consortium, in mid-2020 the group implemented the whole genome sequencing of SARS-CoV-2 virus for surveillance of viral lineages and variants. They identified the first case with the variant of B.1.1.7 in Catalonia in late December 2020.

3. Molecular epidemiology of other infectious diseases. The group applies its considerable experience to other clinically relevant infectious diseases, such as tuberculosis or antibiotic resistant bacteria in collaboration with the personnel from the Microbiology Department.

Group Highlights 2020

- New collaboration with the Surveillance Evaluation and Research Program at Kirby Institute, Australia.
- Participation in the pilot hepatitis C micro-elimination strategy in Pakistani migrants; run by a consortium including ASPCAT and based on technology developed by the group.
- New diagnostic techniques included in the new "Guía de cribado de la infección por el VHC" from the published in July 2020 by the "Ministerio de Sanidad", Spanish government.
- A new research line on SARS-CoV-2 genomic epidemiology was initiated in 2020 with special focus on characterization of outbreaks.

Selected publications 2020


Group: Clinical Virology and New Diagnostic Tools

Group Leader: Elisa Martró, emartro@igtp.cat

Selected publications 2020


**Group: Plasmodium vivax and Exosome Research Group (PvREX)**

**Group Leaders:** Carmen Fernandez-Becerra, Carmen.fernandez@isglobal.org and Hernando A del Portillo (ICREA Research Professor), hdепорtillo@igtp.cat

### Research Overview

**Cryptic infections and exosomes.** Asymptomatic carriers of malaria parasites are a major challenge for malaria elimination. We are presently entertaining the hypothesis that exosomes in P. vivax infections act as intercellular communicators between the bone marrow and the spleen, signalling mechanisms that will unveil the molecular basis of cryptic infections in this species.

**Reticulocyte-derived exosomes (Rex) vaccines against P. vivax.** Preclinical studies in rodent models have demonstrated that exosomes from infections can be explored as a new vaccination approach. Presently, we are pursuing efforts to “tailor” human Rex with P. vivax antigens and to determine their antigen presenting capacities as a new vaccine and delivery platform against P. vivax.

**Extracellular Vesicles and Biomarker discovery.** In the last decade, research on the biology, function and potential applications of extracellular vesicles (EVs) has grown exponentially. One of the most important biomedical applications of this research area is the potential of using EVs as non-invasive biomarkers of clinical diseases. The aim of this research line is to use EVs to identify novel biomarkers in chronic Chagas disease, specifically in the context of therapeutic response and disease prognosis during the chronic infection, as well as the discovery of biomarkers of asymptomatic infections in P. vivax malaria.

This group is jointly affiliated with the IGTP and ISGlobal, through a formal agreement between the institutions.

### Group Highlights 2020

Despite the difficulties and curtailment of travel in 2020 the group continued to advance and publish their research into P. vivax including a paper in Nature Communications.

### Selected publications 2020


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**Area 7: Infectious Diseases**

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**Area 8: Neuroscience**
Group: Vascular Pathologies of the Brain
Group Leader: Antoni Dávalos, adavalos.germanstrias@igenca.cat

Research Overview
The research area of cerebral vascular pathology at the Germans Trias Institute was set up in 2005 and is led by Antoni Dávalos, Director of the Germans Trias i Pujol University Hospital and Clinical Director of the Department of Neuroscience. It is recognized and financed by the Agency for Management of University and Research Grants of the Government of Catalonia (AGAUR) as an accredited emerging group and it forms part of the themed network RETICS-INVICTUS financed by the Instituto de Salud Carlos III.

Research lines
- Endovascular treatment of acute ictus: clinical trials REVASCAT, DAWN
- Reperfusion endovenous therapies and neuroprotection: clinical trials DIAS-3/4, WAKE-UP, TANDEM
- New treatments for secondary prevention of ictus: clinical trials SOCRATES, NAVIGA-TE-ESUS
- futile Rechanneling in Ischemic Acute Stroke (FURIAS): Study of new RM imaging markers for predicting future recanalization in patients undergoing vascular therapy in the acute phase of ictus. FIS P14/01955
- Use of the RACE pre-hospital clinical scale to determine the level of specialization offered to patients with acute ictus in function of its severity and to organize new referral circuits for patients (FIS P13/02041)
- Neuroplasticity, cognitive function and neuroimaging in ischemic cerebral ictus: study of cognitive prognostics, structural changes in white matter, functional RM and cognitive alternations in acute ictus.
- Neurotoxicity of iron in cerebral ischemia
- STRO1-STROECHIP: Validation of a panel of biomarkers for precocious diagnostic of ictus and differentiation from analogous conditions and from ischemic ictus and hemorrhagic ictus.
- Influence of grades of physical activity pre-ictus on functional prognostic, hemorrhagic transformation and arterial rechanneling in acute occlusion of the median cerebral artery.

Group: Cellular and Molecular Neurobiology Research Group (CMN Group)
Group Leader: Teresa Gasull, tgasull@igtp.cat

Research lines
The group works on 5 lines of research:
1. Novel glutamate-related targets for neuroprotection, NMDA-glutamate receptor signalling to death, mechanisms driving excitotoxic death and targets for neuroprotection.
2. Ferroptosis in neuronal death and antife- roptotic neuroprotective compounds. Understand ferroptosis in neuronal death in stroke and other brain diseases: finding new targets of intervention and new treatments.
3. Experimental modeling of stroke in rodents and the gyroencephalic, human-like, swine brain. Models of stroke damage in gyrencephalic brains, with a special focus on damage of the white matter and brain areas connectivity.
4. Discovery of new biomarkers to improve stroke treatment. Discovery of new biochemical and biomedical biomarkers useful to address point of care stroke type identification, stroke patient stratification, patient selection for treatment allocation and/or outcome prediction.

Group Highlights 2020
- Experimental modeling of stroke in adult ro- dent and gyrencephalic human-like brains: focus on damage of the white matter and brain areas connectivity
- New partnership with Professor Piotr Walczak (University of Maryland, US) the team at the Ti-Com (Poland)
- New partnership with Dr. Clara Prats for the computational machine/deep learning assessment and prediction of brain damage and neurological outcome in preclinical stroke models
- Topic Editors of the journals Cells (TC) and Int. J. Mol. Sci. (CM-S).

Selected publications 2020
Muscle single-cell analysis in patients with myotonic dystrophies (G. Nogales)

Application of more sensitive genetic diagnostic techniques, study of phenotype modulation and prognostics in patients with myotonic dystrophies (G. Nogales)

Muscle single-cell analysis in patients with myotonic dystrophy type 1 (G. Nogales)

• Antisense oligonucleotides therapy in patient-derived cell models of Steinert disease (G. Nogales)

• Establishment of predictive markers of functional recovery prior to acute ischemic stroke (A. Martínez-Piñeiro)

• Improved diagnosis and testing of treatments for myotonic dystrophy type 1 (A. Ramos)

Group Highlights 2020

In 2020 Alicia Martínez Piñeiro founded a spin-off company together with Dr Antoni Dávalos, Dr Jaume Coll-Canti. Time is Brain will develop a medical device to improve the diagnostics and prognostics of acute ischaemic stroke. The company also received the Seal of Excellence from the European Commission and is preparing for its seed-funding round.

Selected publications 2020


5. Improved diagnosis and testing of treatments for myotonic dystrophy type 1 (A. Ramos)

Group: Neurogenetics

Group Leaders: Antoni Matilla Dueñas, amatilla@igtp.cat

Research Overview

The IGTP Neurogenetics Research Group investigates the genetic and molecular mechanisms underlying neurodegenerative processes, in particular inherited ataxias. The ultimate goal of the research is to identify the genes, their products and molecular pathways involved in order to effectively provide genetic diagnosis and eventually develop selective therapeutic approaches to patients. The group uses multidisciplinary strategies to identify genes, proteins and other gene products involved in the function and dysfunction of the nervous system by using next-generation RNA and DNA sequencing, functional assays, biochemical, proteomics, and molecular neuro signalling studies. Furthermore, the team develops large-scale genomics technologies and bioinformatics tools to identify genetic causes underlying neurological diseases in many undiagnosed genetic diseases.

Selected publications 2020


4. By combining some of these approaches, the group has recently identified 2 novel ataxia subtypes and characterised their gene products and the molecular pathways involved.

An important objective of the group is to identify and implement treatments for various neurodegenerative diseases such as ataxias and Sanfilippo Syndrome. To this aim, we have developed an AAV-gene therapy for Friedrich’s ataxia that has proven safe and long-term efficient in 2 different mouse models of the disease.

Group Highlights 2020

1. Completion of the pre-clinical trial to evaluate safety and efficiency of the AAV-gene therapy vector for the treatment of Friedrich’s ataxia.

2. Identification of a new spinocerebellar ataxia subtype.
Group: Genomics and Transcriptomics of Synucleinopathies (GTS)

Group Leader: Katrin Beyer, kbeyer@igtp.cat

Research Overview

Synucleinopathies include Parkinson’s disease (PD), the most frequent movement disorder, and dementia with Lewy bodies (DLB) the second most frequent cause of degenerative dementia after Alzheimer’s disease (AD). In PD and DLB, intra-neuronal inclusion bodies, so-called Lewy bodies, develop after abnormal alpha-synuclein oligomerization and aggregation in vulnerable brain areas. DLB is also characterized by an important neuropathological overlap with AD resulting in overlapping clinical presentation and making a reliable diagnosis very difficult. So far, there are no peripheral DLB diagnostic markers and up to 80% of DLB patients are still misdiagnosed, mainly as having AD. These patients are treated as if they had AD and about 50% develop severe adverse reactions to the treatment administered, which irreversibly worsens their condition.

The molecular characterization of DLB is of paramount importance as it constitutes the basis for the successful identification of disease biomarkers. The GTS group focuses on the genetic characterization of DLB, which was only described as a separate disease 20 years ago. Following the workflow “from the brain to the periphery”, the group aims to identify which of the disease-specific changes found in the brain may be reflected in peripheral biofluids to establish diagnostic DLB biomarkers. Some of the results have been patented as biomarkers for DLB, two for the identification of specific DLB subgroups, one to monitor the treatment with DLB, two for the identification of specific DLB results have been patented as biomarkers for establishing diagnostic DLB biomarkers. Some of the research topics have become of one of their main objectives.

Research lines

- Genetic characterization of DLB. DLB-specific genetic variations in brain, functional analyses of promoter, intronic and 3’UTR variants. Expression and alternative splicing analyses of DLB genes in brain; confirmation in peripheral sources (blood, saliva). Analysis of mRNA expression changes in brain and blood.

Group Highlights 2020

In 2020 a new research line was created: characterization of platelet function and dysfunction in Lewy body disorders. Currently, the latter two are being further developed to provide useful tools for application in clinical practice. Our latest findings indicate that specific blood cells may be directly involved in DLB pathogenesis. Consequently, the group started on the characterization of these cells and this new research topic has become one of their main objectives.

Selected publications 2020


Group: Psychoneuroendocrinology and Stress in Psychosis (PSICPNEC)

Group Leader: Javier Labad, jlabad@csdm.cat

Research Overview

The Research Group in Psychoneuroendocrinology and Stress in Psychosis (PSICPNEC) is composed of researchers from the Mental Health Departments at the Consorci Sanitari del Maresme (Hospital de Mataró) and Parc Taulí Hospital, affiliated to the IGTP. The main scientific interest of the group is the study of the relationship between hormones and behaviour (Psychoneuroendocrinology) in patients with a psychotic disorder or at risk of developing a psychotic disorder (at-risk mental states). Research lines include the study of the neurobiological mechanisms of stress (hypothalamic-pituitary-adrenal axis) in the pathogenesis and outcome of psychotic disorders. One of the aims of the group is to study the role of hormones in the risk of transition to psychosis in vulnerable populations and the association with a more severe phenotype (eg cognitive impairment) in established psychoses. Other research lines are focused on the study of the role of gender and hormones in the therapeutic response to pharmacological, psychotherapeutic, and cognitive rehabilitation interventions in psychotic disorders. Recent research includes the study of stress-related biomarkers in animal models in collaboration with researchers of the Neuroscience Translational Unit IUB-Parc Taulí.

Research lines

1. Stress-related biomarkers in early psychosis and in people at risk of developing a psychiatric disorder.
2. Impact of hormones on the clinical expression of psychotic disorders.
3. Psychopathological and biological consequences of abuse in adolescents and young adults.

Group Highlights 2020

Coordination of a multi-centre European project dealing with the study of stress-related biomarkers in people with psychosis and animal models (ERA-NET NEURON project of 3 centres).

Selected publications 2020

Group: Medical complications of substance use disorder (GIAS)

Group Leader: Robert Muga rmuga.germanstrias@gencat.cat

Research Overview

The group researches the medical consequences of Substance Use Disorder, although group members have increased their clinical duties because of the COVID-19 pandemic. It is a consolidate group recognized by the AGAUR of the Government of Catalonia.

The main areas of research include cardiometabolic complications, liver damage and systemic inflammation of alcohol use disorder and the impact of drug-related diseases on patient morbidity and mortality. The team focuses especially on the complications of opiates, cocaine, THC and poly-drug use.

The group collaborates with researchers from the European Union, United States and Switzerland and is currently a member of the Spanish Network on Addictive Disorders (Red de Trastornos Adictivos/RTA-RETICS, ISCIII). Members mentor PhD candidates and serve as Scientific advisors for GALEA, a start-up company devoted to the development of new drugs for the treatment of alcohol-related liver disease. Dr Muga also serves as expert consultant for research at the Public Health Agency of Catalonia, Program on Prevention, Control and Care for HIV, STIs and Viral Hepatitis -PCA VI-VH.

Group Highlights 2020

The group has secured new research funds three competitive research projects from the Instituto de Salud Carlos III (ISCIII) and Plan Nacional Sobre Drogas/PNSD-Ministry of Health) and from two career development awards for Young researchers: the Juan Rodés Program (Paola Zuluaga) and the Sara Borrell Program (Núria Garcia-Marchena), both funded by the ISCIII.

In 2020, the research group published 15 papers in peer-reviewed scientific journals and 2 book chapters. The group has also been working on manuscripts that will be published in 2021.

Selected publications 2020


Area 9: Science of behaviour and substance abuse
Group: Clinical pharmacology of substance use disorders
Group Leader: Magí Farré, mfarre.germanstrias@gencat.cat

Research Overview
The objectives of the group are to study the acute and chronic pharmacological and toxic effects caused by substance abuse in humans. Most of the members of the group are physicians at the Germans Trias i Pujol Hospital responsible for daily patient care. The three main active research lines are:

- Evaluation of the acute effects of new psychoactive substances like synthetic cathinones (such as mephedrone, methyleneone and alpha-PVP, MDPV), and synthetic cannabinoids.
- Evaluation of the acute and chronic effects of binge alcohol consumption in young people and its combination with energy drinks.
- Evaluation of the effects of cannabis and its components, including its possible therapeutic use (medicinal cannabis).

In all three lines of research this evaluation includes pharmacodynamics, pharmacokinetics and metabolic aspects and biomarkers associated with consumption.

Group Highlights 2020
The group has been awarded competitive funding (projects starting 2021) from the ISCIII; one for the clinical trials platform and two research projects.

Selected publications 2020