IGTP
Germans Trias i Pujol Research Institute

Annual Scientific Report 2021

HR EXCELLENCE IN RESEARCH

Instituto de Salud Carlos III

CERCA Centres de Recerca de Catalunya

Index

Introduction

Introduction

2021 has been an intense year of activity and many important milestones. The institute has seen an overall increase in active projects and a higher success rate, especially in international projects; support for international project management has been reinforced to continue this trend. We have also seen excellent results for Spanish networks, with amongst others, five RICORS Networks awarded (*Redes de Investigación Cooperativa Orientada a Resultados en Salud*), which represents a 100% success rate.

In a similar line, the consolidation of our constant steady work EATRIS has culminated in the IGTP participating in the ground-breaking ISIDORe project as a member of EATRIS. The project aims to network and prepare European health research to tackle future pandemics and represents an extremely important strategic goal for an institute and campus so strong in research into infectious diseases.

Both of our strategic projects have reached important milestones in 2021. The CMCiB has seen increasing activity, training and alliances and as a consequence an important rise in publications, ten of these alone from the mathematical modelling group. Clinical research using MRI is now taking place in addition to the 80% of preclinical MRI work already ongoing. Licensing to use genetically modified organisms and an important contribution to the first Spanish COVID-19 vaccine have been highlights in a year, which also saw the award of the Best Laboratory Practices Certificate giving a green light to the development of medical devices.

The GCAT|Genomes for Life Cohort has also shown excellent results as more projects publish their results. The cohort profile was published in the British Medical Journal Open and the project contributed to the paper “Host Genetics Initiative. Mapping the human genetic architecture of COVID-19” published in *Nature*.

We are proud that our Innovation and Business Development has continued to consolidate and this year saw the evaluation of participation in a new spin-off company along with BIOCAT and 21 projects in the IGTP project valorization pipeline. The unit continues to work closely with hospital to identify and move projects from pre-incubation stage at the hospital to proof of concept and incubation at the IGTP.

In research we are building on previous work to forge and strengthen collaborations between groups at the various affiliated centres on the campus and particularly to reinforce the relationship with our primary care research groups. In cancer, this has meant working to set up a new transversal collaborative research programme to advance basic and translational research towards innovation and transference of technology, establish more efficiency through a firm network, increase impact and bring advanced computational tools to translational research practices

Introduction

In other areas the IGTP has continued to deliver. It published its new Gender Equality Plan in early 2021 in line with Horizon Europe requirements and its Protocol for the Prevention of Harassment in September. The IGTP is working on actions to support the zero-tolerance policy towards all kinds of harassment. It is also working to produce guidelines for the inclusion of the gender perspective in all biomedical research taking place.

Despite the continued restrictions due to continuing waves of the pandemic in 2021 the IGTP has participated in the European Researcher's Night in a ground-breaking project in collaboration with the Èpica Foundation of the transgressive theatre company *La Fura dels Baus*. To paraphrase one of our participating junior scientists, we have seen how the worlds of science and art can work together to communicate in a simpler way.

Such projects are an important part of communicating our activities and achievements within our mission to carry out highly efficient translational research to improve people's health and quality of life. I very much hope you enjoy reading this report and that it reflects the dedication and excellence of our researchers and support staff to biomedical research.

Jordi Barretina
Director, IGTP

The IGTP in Numbers

The IGTP in Numbers

Research areas and groups

34

GROUPS WITH PI contracted directly by the IGTP, Germans Trias I Pujol University Hospital or affiliated groups from the Catalan Institute of Oncology (ICO) or ISGLobal.

8

AFFILIATED INSTITUTIONS

- IGTP, Catalan Oncology Institute (ICO) and ISGlobal
- Josep Carreras Leukaemia Research Institute (IJC)
- IrsiCaixa AIDS Research Institute
- Fight Infectious Diseases Foundation (FLS)
- IDIAP Jordi Gol Foundation
- Maresme Health Consortium (CSdM)
- Guttmann Institute

9

RESEARCH AREAS

Science of Behaviour and Substance Abuse	Immunology and Inflammation	Cardiovascular and Respiratory Disease
Infectious Diseases	Endocrine and Diseases of the Metabolism, Bones and Kidneys	Diseases of the Liver and Digestive Tract
Cancer	Neuroscience	Community Health

CONTRACTED AND AFFILIATED RESEARCH GROUPS 2021

34	25	12	8	7	6	5
IGTP	IJC	IrsiCaixa	IDIAP J Gol	CSdM	Fundació Lluita	Guttmann

Networks

18
SGR Groups accredited by the Government of Catalonia

5
Centros de Investigación Biomédica en Red (CIBER)

5
Redes Temáticas de Investigación Cooperativa en Salud (RETICS)

5
Redes de Investigación Cooperativas orientadas a Resultados en Salud (RICORS)

2
Others (SCREN/Biobancs i Biomodelos)

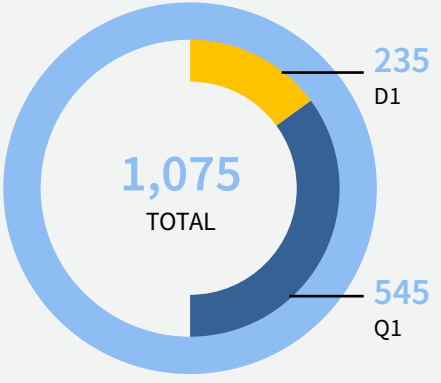
1
European comission ERIC (EATRIS)

Publications in 2021

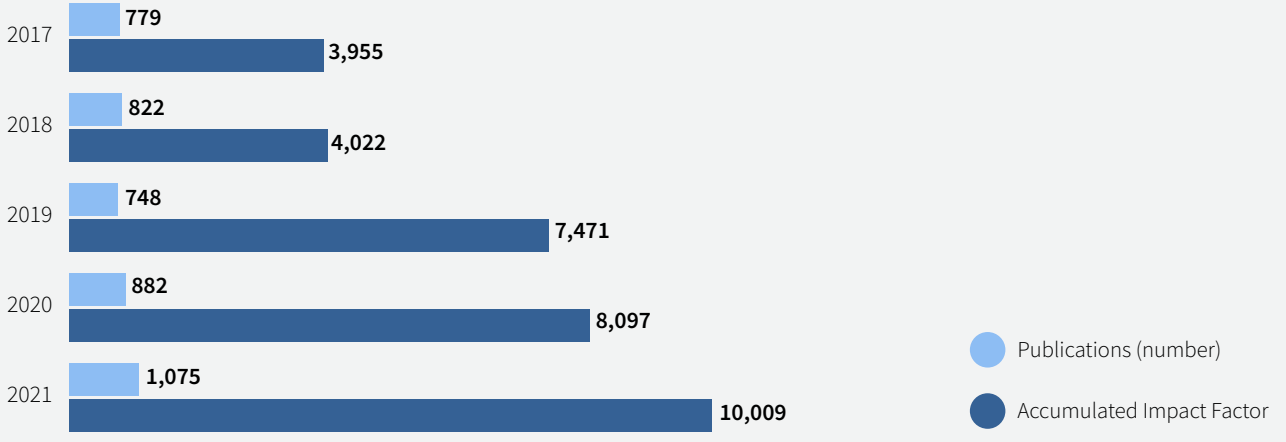
10,009
TOTAL IMPACT FACTOR

9.31
AVERAGE IMPACT FACTOR

1,075
TOTAL PUBLICATIONS

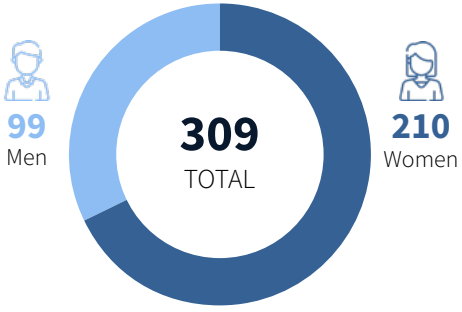


EVOLUTION

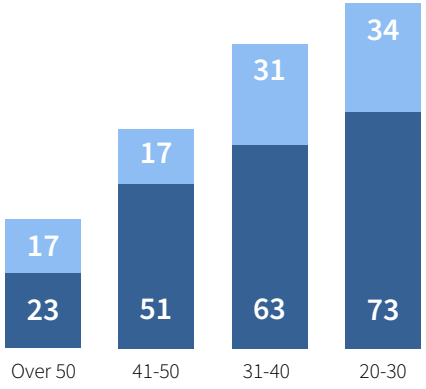


People: IGTP contracted and affiliated staff

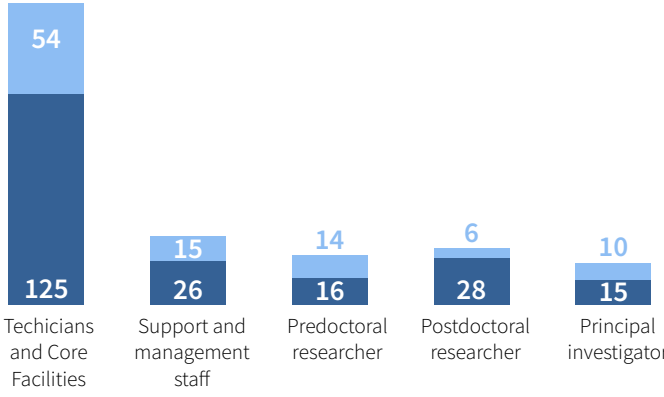
IGTP CONTRACTED STAFF 2021



Age

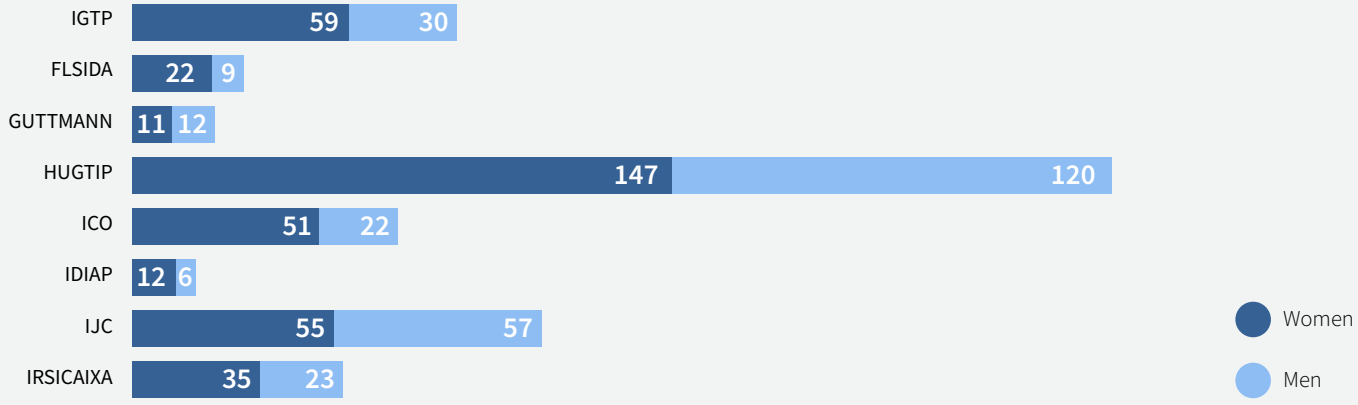


Professional Categories



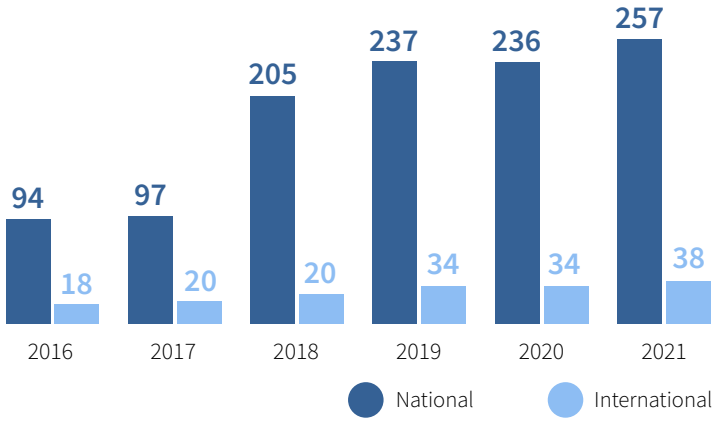
IGTP CONTRACTED AND AFFILIATED RESEARCHERS

Total researchers by Campus institution

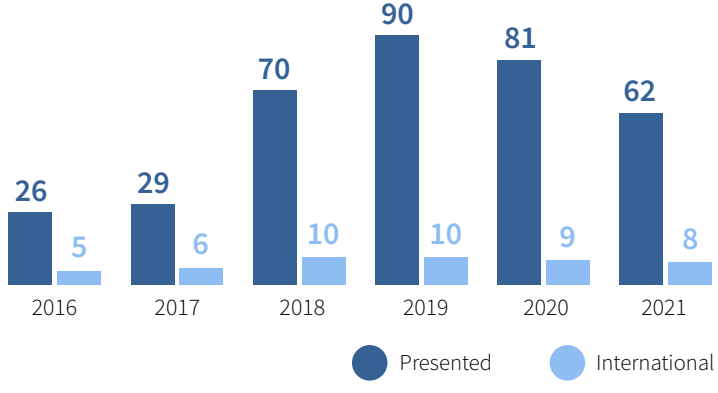


Competitive Projects

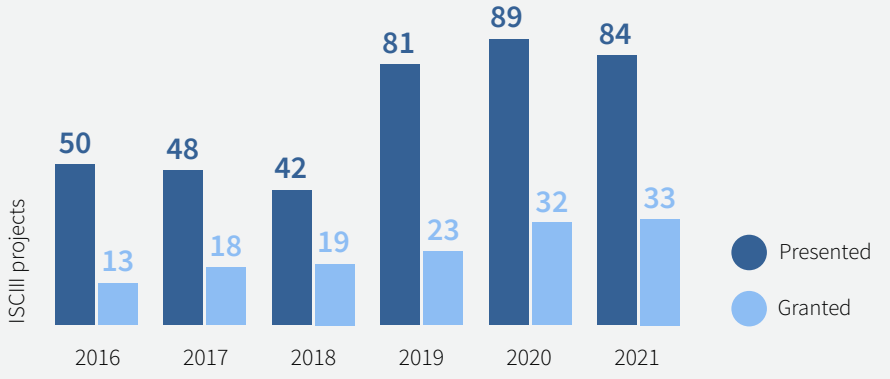
TOTAL ACTIVE PROJECTS 2016-2021



INTERNATIONAL PROJECTS 2016-2021



FUNDING FROM ISCIII



Innovation and Technology Transfer

16
INNOVATION REQUESTS

77,441€
TOTAL REVENUE

1
New patent applications

1
New spinoffs

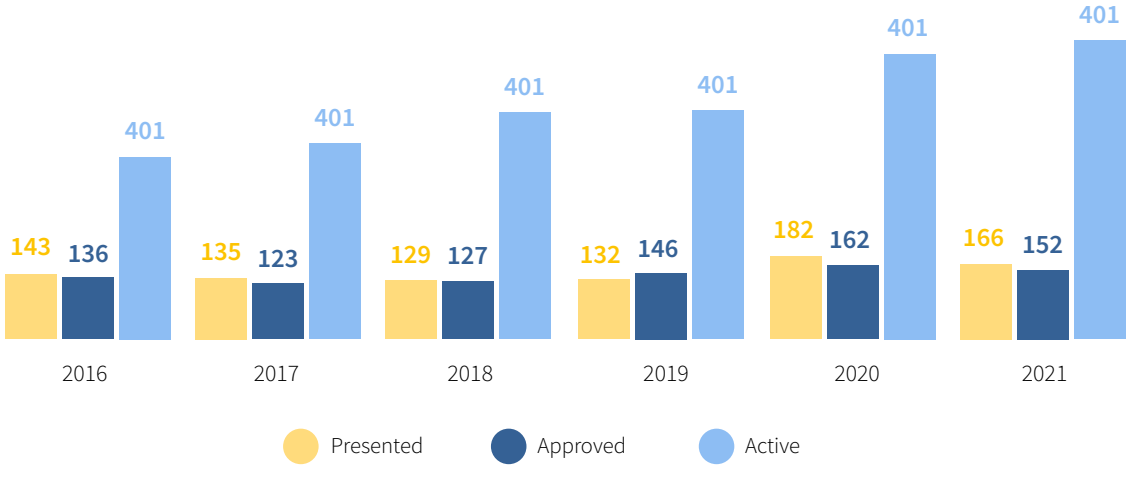
2
New licenses

34
Total active patent (families)

7
Total spinoffs

17
Total licenses

Clinical trials



Clinical trials 2021

166
Ongoing clinical trials

37
Trials evaluated by ethical committee

152
Trials approved

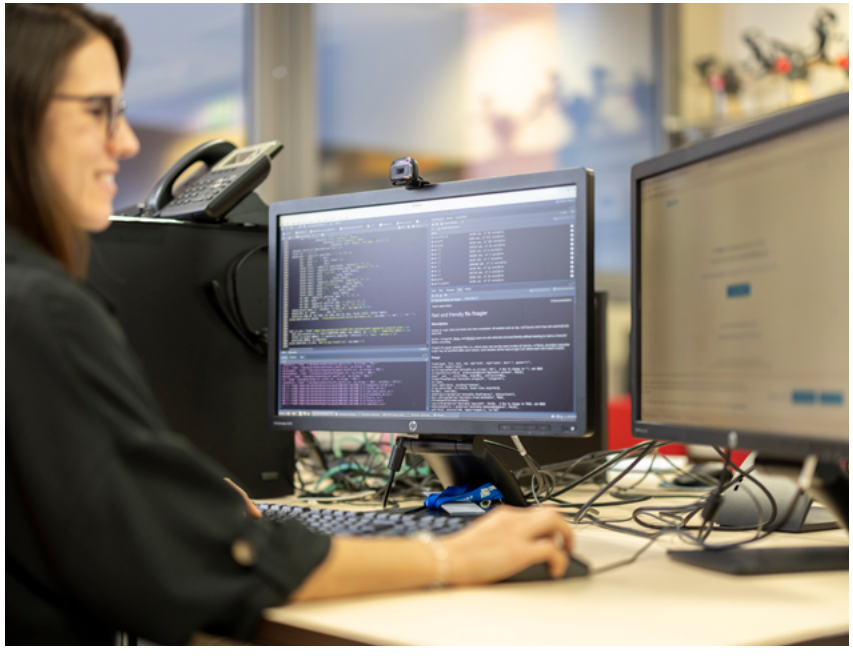
Strategic Projects

GCAT|GENOMES FOR LIFE PROJECT (2018-2021)

18
Partners

32
Projects

23
Papers



THE CENTRE FOR COMPARATIVE MEDICINE AND BIOIMAGE (CMCIB)

CMCiB Users

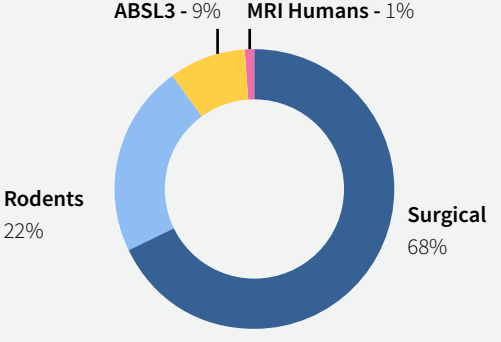
136
CEEA approved projects

240
CMCiB users

37
Customers

>600
Surgeons trained (cumulative)

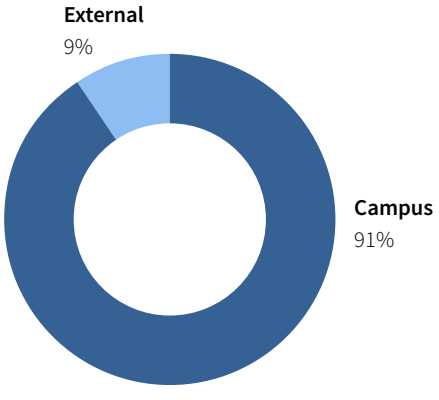
Activity by area



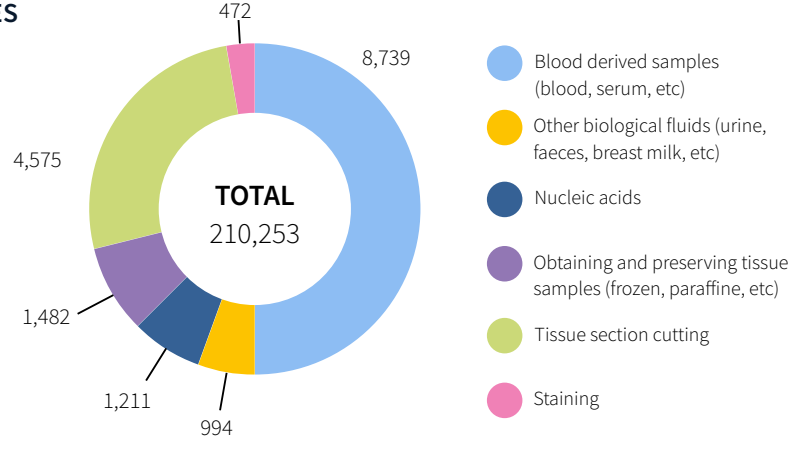
Core facilities

BIOBANK

PROJECTS

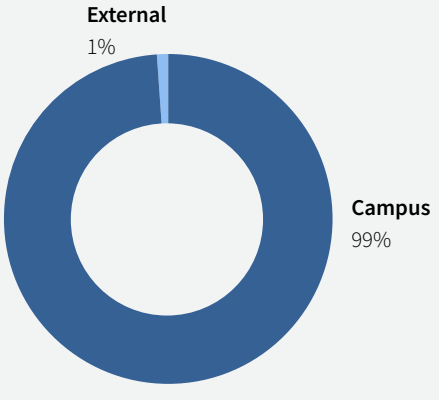


SERVICES

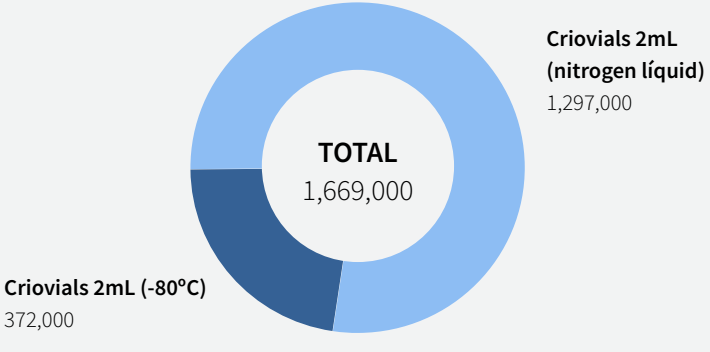


CRIOBIOLOGIA

PROJECTS

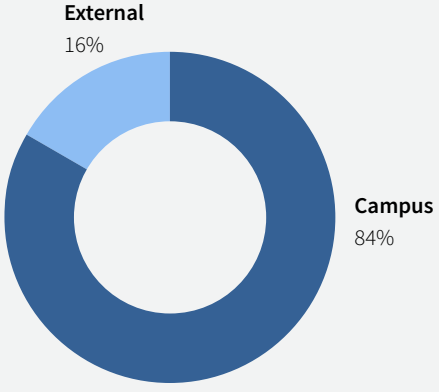


STORED SAMPLES

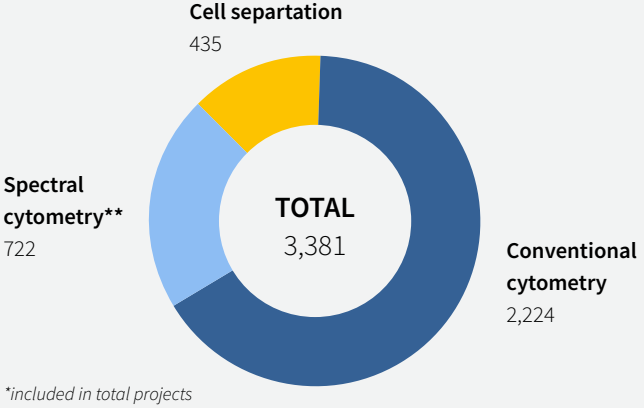


CYTOMETRY

PROJECTS



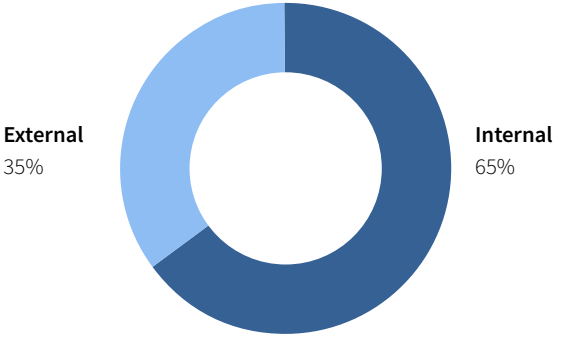
TYPE OF SERVICE (HOURS)



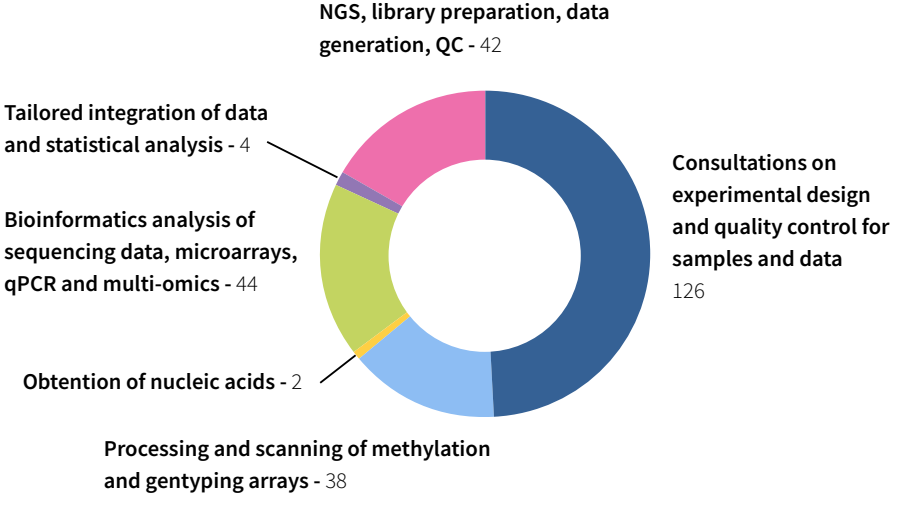
*included in total projects

HIGH THROU GENOMICS

PROJECTS

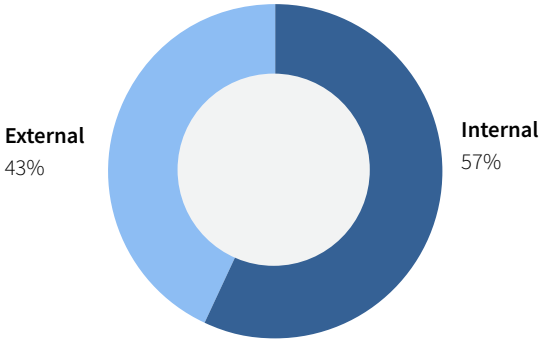


TYPE OF SERVICE



HIGH PERFORMANCE COMPUTING

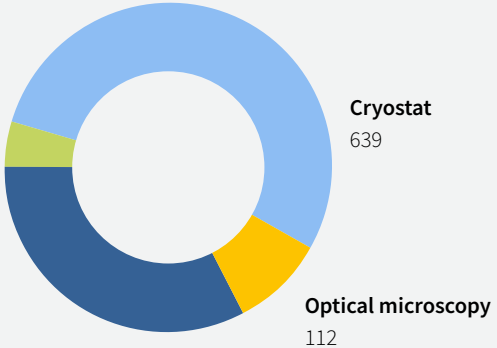
PROJECTS



MICROSCOPY

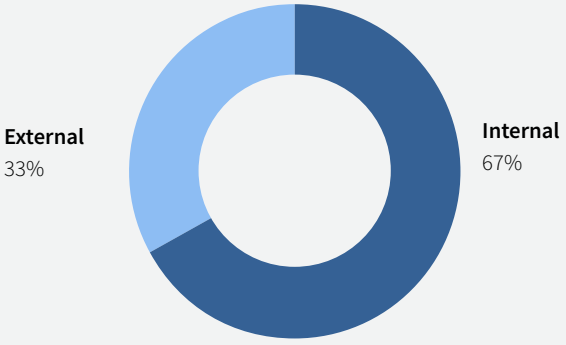
36
Projects

TYPE OF SERVICE

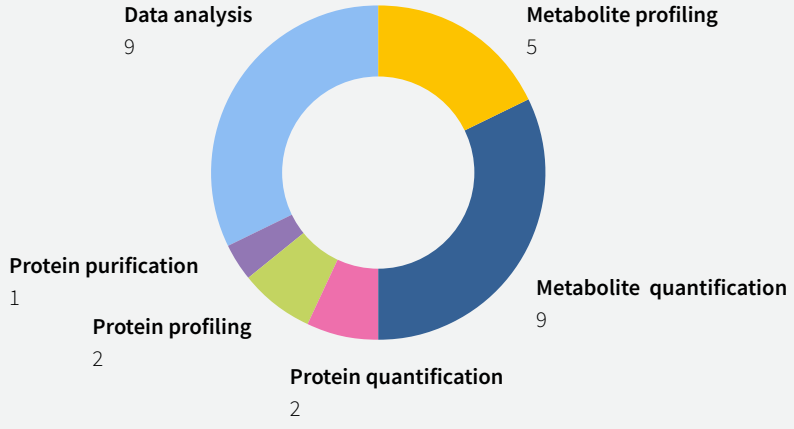


PROTEOMICS AND METABOLISM

PROJECTS

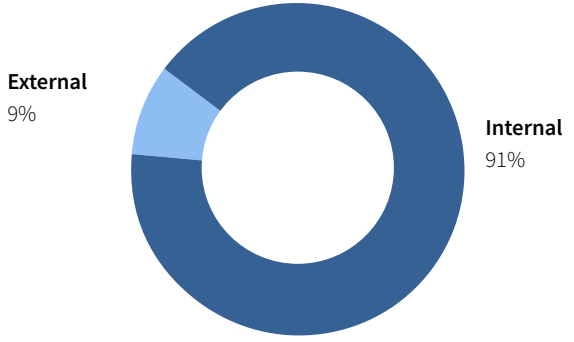


TYPE OF SERVICE

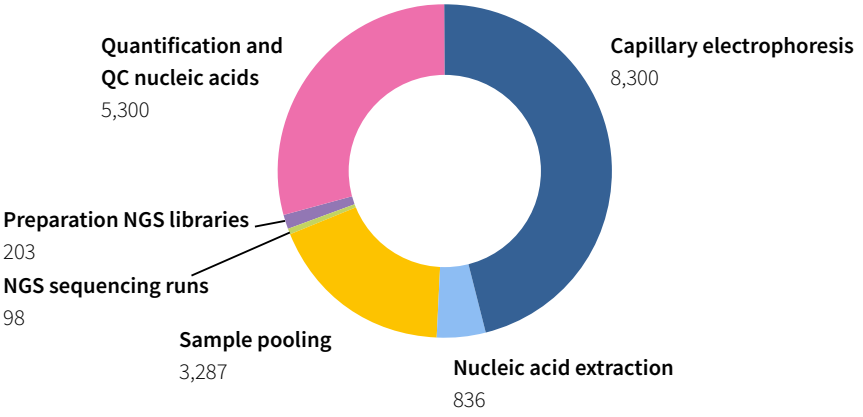


TRANSLATIONAL GENOMICS

PROJECTS

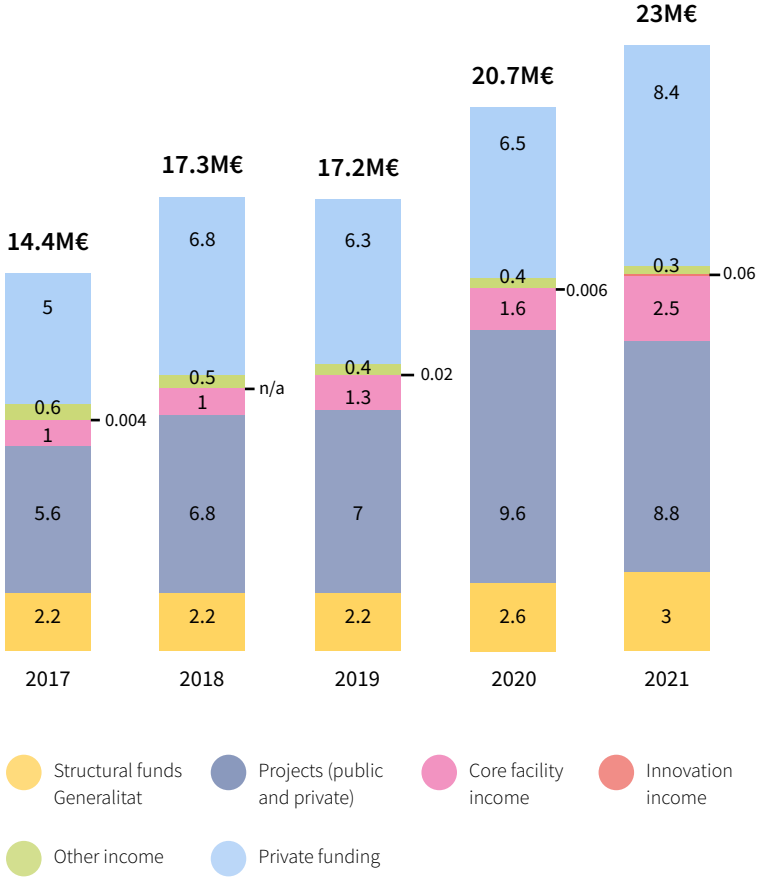


NUMBER OF SAMPLES PROCESSED PER SERVICE

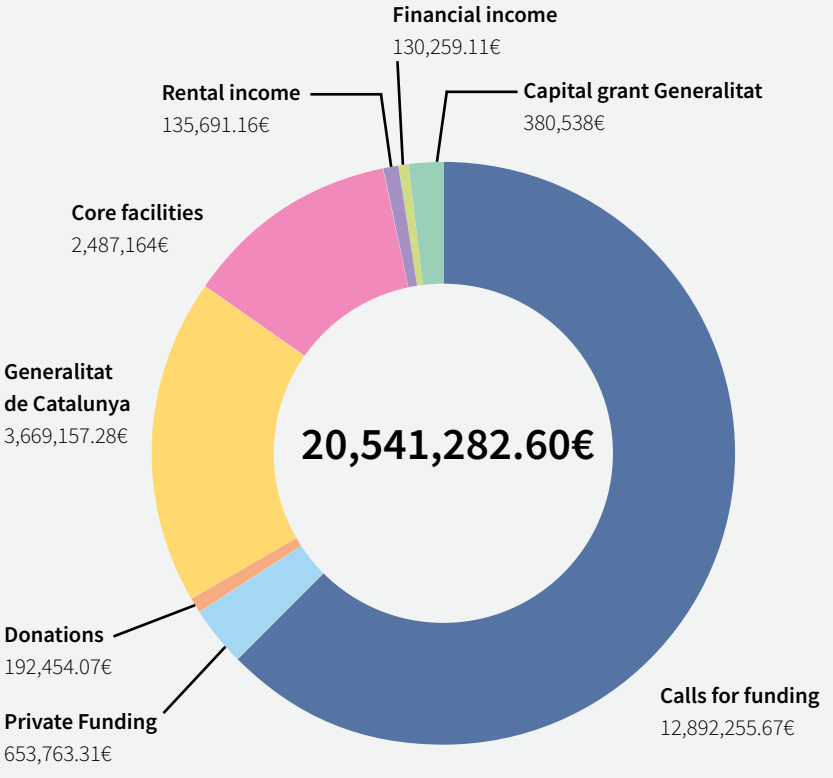


Sources of Funding

ANNUAL EVOLUTION AND DISTRIBUTION OF FINANCING BY ORIGIN OF FUNDS (2017-2021) M€



FUNDING FOR 2021



Scientific Activities in 2021

Scientific Activities in 2021

Projects

2021 has been a year of transition from the crisis measures enforced by the Covid-19 pandemic to a return to activities to consolidate the IGTP in national and international networks and increase international funding. The total number of active national and international projects increased, despite a slight drop in projects presented. In spite of this, the award rate was much higher than preceding years.

The IGTP secured one more AES grant than in 2020, but increased overall funding. One was granted an individual project from the Department of Defense (DOD-NIH).

The hard work to increase visibility over recent years by the IGTP and the affiliated centres on the campus showed some important results in 2021. The IGTP joined ISIDORe, a Horizon Europe project with funding of 21 million euros. As a third party through the ISCIII, the IGTP participates in a project of the European Centre for Disease Prevention and Control (ECDC-EU).

ISIDORe provides free access to all the research resources and services to study epidemic prone pathogens

ISIDORe in a nutshell

21M€

300+
Services

32
Countries

154
Partners

Project Highlights in 2021

- Horizon Europe Project ISIDORe (Integrated Services for Infectious Diseases Outbreak). Total funding 21M€. IGTP particpates as a member of EATRIS alongside 154 partners.

- Department of Defense (DOD-NIH) individual grant to Eduard Serra for the project NF1-Associated Peripheral Nerve Sheath Tumors at Single-Cell Resolution: Heterogeneity, Tumor Growth, and Malignant Progression with the collaboration of CNAG and IDIBELL.

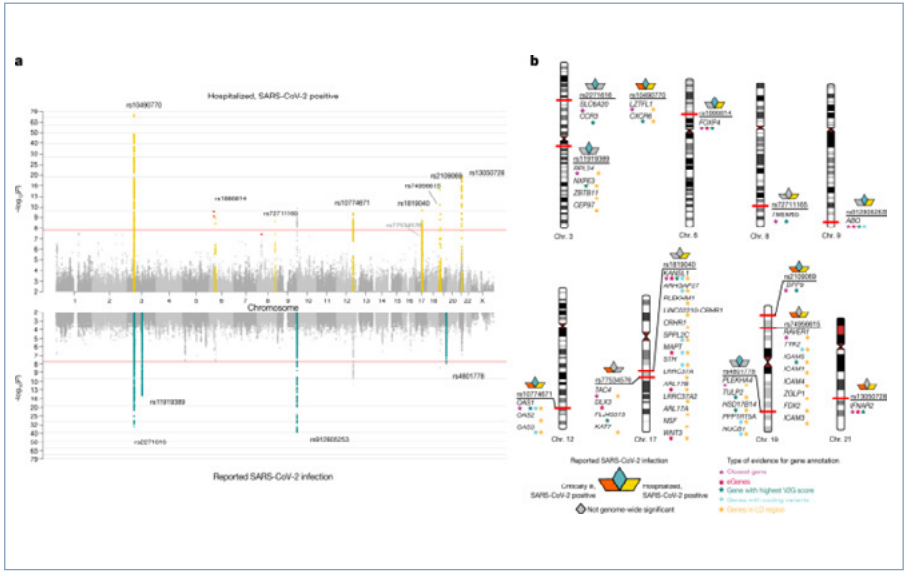
- Five projects from the *Redes de Investigación Cooperativa Orientada a Resultados en Salud (RICORS)* with 100% success rate of applications. Projects awarded to Robert Muga, Mònica Millan, Cristina Ramo, Marcel·la Franquesa and Jose Maria Ribera.

- New CIBER network leadership/New membership of CIBER network (CB21/13/00063) for Javier Martínez-Picado.

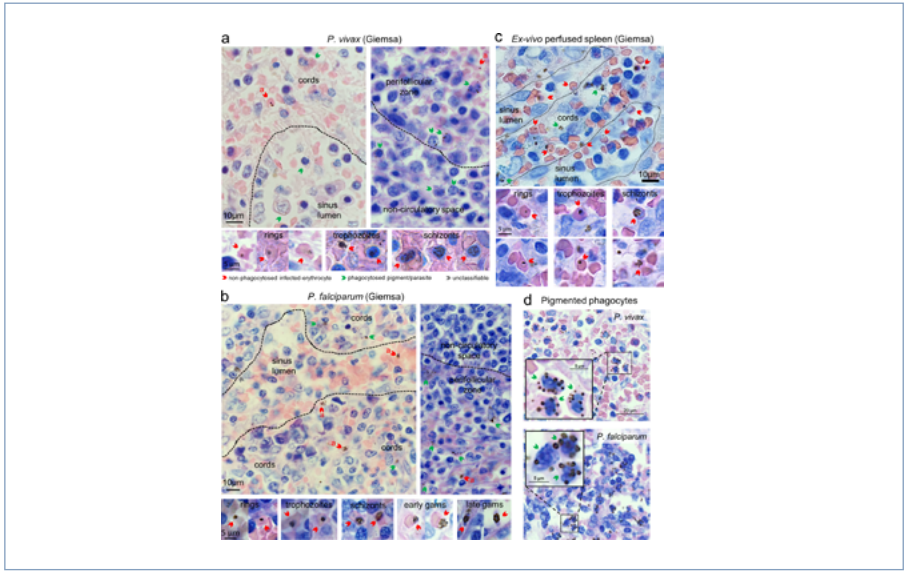
Publications

In 2021 the IGTP had a total of 1075 publications and increased its accumulated and average impact factor.

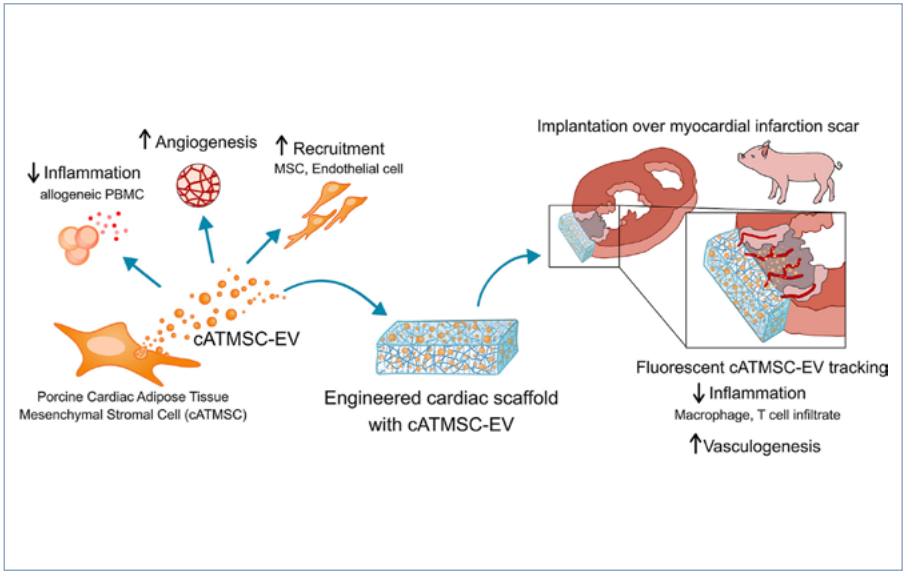
Publication Highlights in 2021



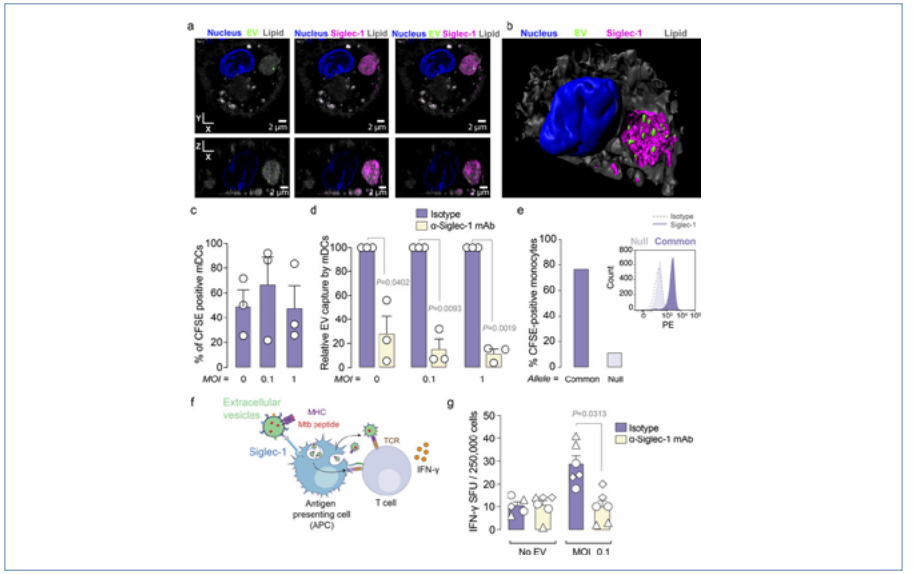
COVID-19 Host Genetics Initiative. Mapping the human genetic architecture of COVID-19. Nature. 2021 Dec;600(7889):472-477. doi: 10.1038/s41586-021-03767-x. Epub 2021 Jul 8. PMID: 34237774; PMCID: PMC8674144. Participation of the GCAT|Genomes for Life cohort.



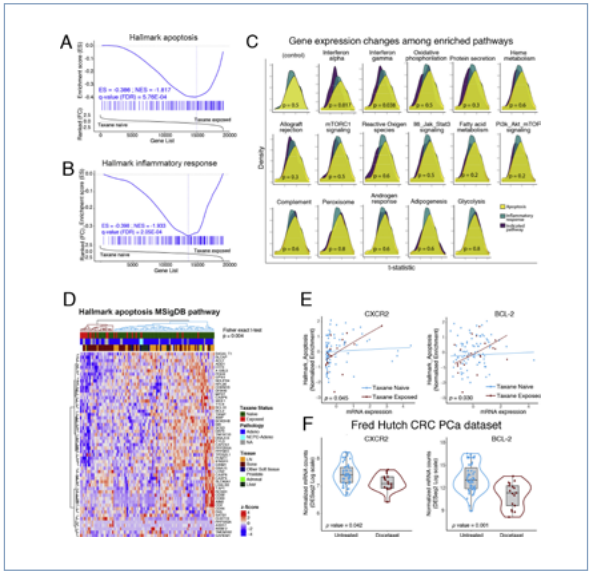
Evaluation of splenic accumulation and colocalization of immature reticulocytes and Plasmodium vivax in asymptomatic malaria: A prospective human splenectomy study. PLOS, May 26, 2021, https://doi.org/10.1371/journal.pmed.1003632. Steven Kho et al.



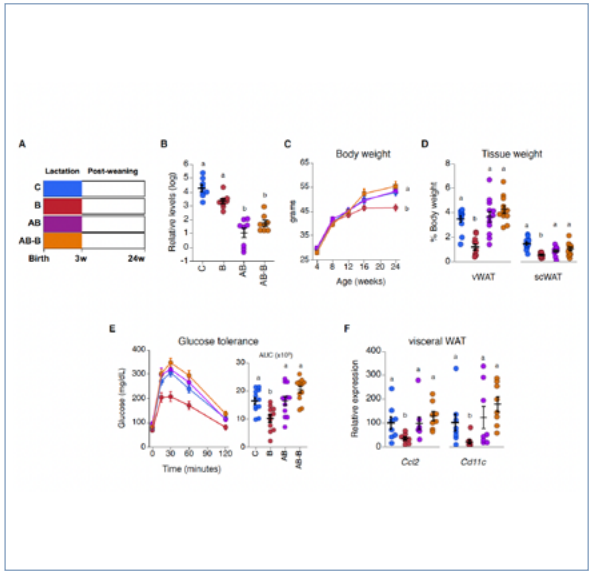
Monguió-Tortajada et al, Bioactive Materials Volume 6, Issue 10, October 2021, Pages 3314-3327. **Local administration of porcine immunomodulatory, chemotactic and angiogenic extracellular vesicles using engineered cardiac scaffolds for myocardial infarction.** https://doi.org/10.1016/j.bioactmat.2021.02.026



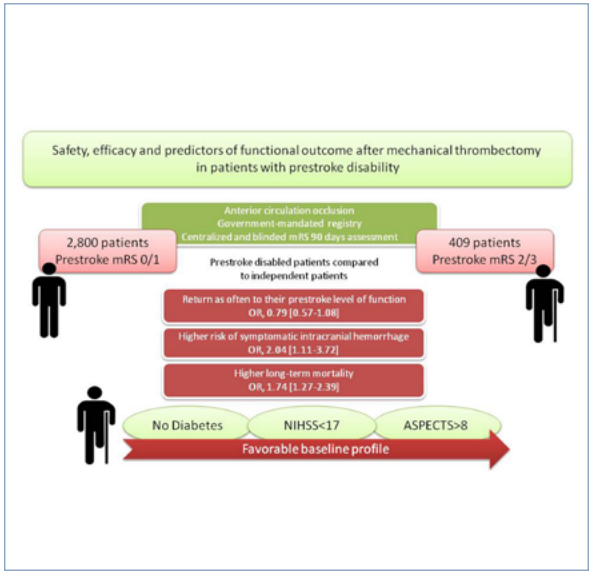
Dissemination of *Mycobacterium tuberculosis* is associated to a SIGLEC1 null variant that limits antigen exchange via trafficking extracellular vesicles. J Extracell Vesicles. 2021 Jan;10(3):e12046. doi: 10.1002/jev2.12046. Epub 2021 Jan 14. PMID: 33489013; PMCID: PMC7807485. Benet S, Gálvez C, Drobniewski F, Kontsevaya I, Arias L, Monguió-Tortajada M, Erkizia I, Urrea V, Ong RY, Luquin M, Dupont M, Chojnacki J, Dalmau J, Cardona P, Neyrolles O, Lugo-Villarino G, Vérollet C, Julián E, Furrer H, Günthard HF, Crocker PR, Tapia G, Borràs FE, Fellay J, McLaren PJ, Telenti A, Cardona PJ, Clotet B, Vilaplana C, Martinez-Picado J, Izquierdo-Useros N



Taxane-induced Attenuation of the CXCR2/BCL-2 Axis Sensitizes Prostate Cancer to Platinum-based Treatment. Vicenç Ruiz de Porras, Xieng C. Wang, Luis Palomero, Mercedes Marin-Aguilera, Carme Solé-Blanch, Alberto Indacochea, Natalia Jimenez, Sara Bystrup, Martin Bakht, Vincenza Conteduca, Josep M. Piulats, Oscar Buisan, José F. Suarez, Juan Carlos Pardo, Elena Castro, David Olmos, Himisha Beltran, Begoña Mellado, Eva Martinez-Balibrea, Albert Font, Alvaro Aytes, European Urology, Volume 79, Issue 6, 2021, Pages 722-733, ISSN 0302-2838, doi.org/10.1016/j.eururo.2020.10.001.



Increasing breast milk betaine modulates Akkermansia abundance in mammalian neonates and improves long-term metabolic health. Silvia Ribo et al. Science Translational Medicine, 31 Mar 2021, Vol 13, Issue 587, DOI: 10.1126/scitranslmed.abb0322



Predictors of Functional Outcome After Thrombectomy in Patients With Prestroke Disability in Clinical Practice. Mònica Millán et al and on behalf of the Cat-SCR Consortium. Stoke, Vol. 53, No. 3, Originally published27 Oct 2021 doi.org/10.1161/STROKEAHA.121.034960Stroke. 2022;53:845–854

Events

In 2021 the IGTP organized a series of events to foment cohesion and collaboration between groups from different affiliated centres on the campus. Despite continued restrictions and limitations on in-person meetings the events went ahead online.

In January the **Can Ruti COVID-19 Network Session** saw 40 mini presentations from a total of 188 participating authors. The online session was attended by 144 scientists an several project consortia were formed as a result.

February saw the **3rd Can Ruti Women in Science Working Group Symposium: Gender Perspective of the effects of the COVID-19 pandemic**. The event was held online and included the presentation of results of original research into the gendered effects of the pandemic on research staff and research output on the campus.

In May the IGTP held it's **EATRIS Spain Meeting** online to inform researchers on the campus of the activities of the IGTP EATRIS Coordination Committee and to present new advances of EATRIS Spain and successful case histories. The event was attended by senior leaders of EATRIS Spain and 54 researchers.

The **Second IGTP Scientific Retreat** was held at the Badalona International Conference Centre (BCIN) in a mixed format. Selected groups presented 57 abstracts and 8 strategic talks, the permitted maximum of 50 people attended in person with 236 joining online. The round table focussed on Innovation and Technology Transfer.

In September, several research groups from the IGTP participated in an innovative project to explain science to the general public in the content of **European Researchers' Night** in an event run by the Èpica Foundation, of the transgressive theatre company La Fura dels Baus. The IGTP and four other international research institutions took part in a performance event and a family science fair.

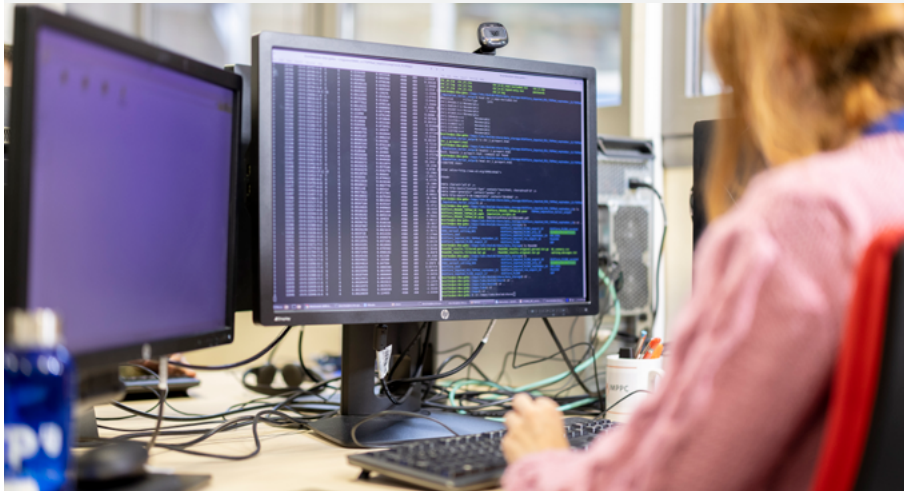
Other events organized by the IGTP in 2021 included the final talks in the Can Ruti Biomedical Series featuring leading international scientists, which had been postponed from 2020 due to the pandemic and the coffee talks training series for young scientists which continued throughout the year online. The CEEISCAT Group at the IGTP started the Can Ruti Sessions on STDs and the IGTP provided support for the Can Ruti PhD Students Committee, who organized three seminars and their annual symposium.

Strategic Projects

The IGTP has **two transversal strategic projects** aimed at promoting research and supporting projects studying fundamental areas of human Health from two different aspects.

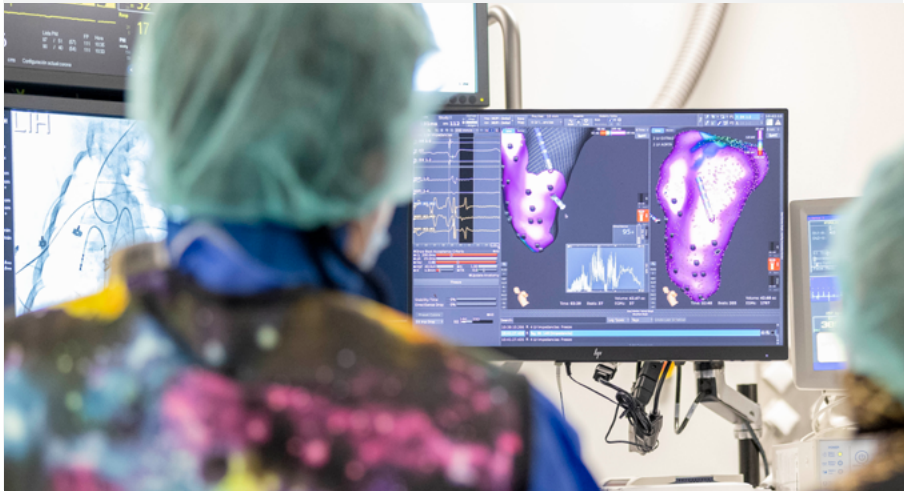
GCAT|GENOMES FOR LIFE PROJECT

The GCAT|Genomes for Life project is a prospective cohort networked nationally and internationally contributing to the surge in use of omics and data science to advance predictive and genomics medicine.



THE CENTRE FOR COMPARATIVE MEDICINE AND BIOIMAGE (CMCIB)

The Centre for Comparative Medicine and Bioimage (CMCiB) is dedicated to developing and using alternative models for experimentation and partnering in innovative imaging technology and surgical techniques.

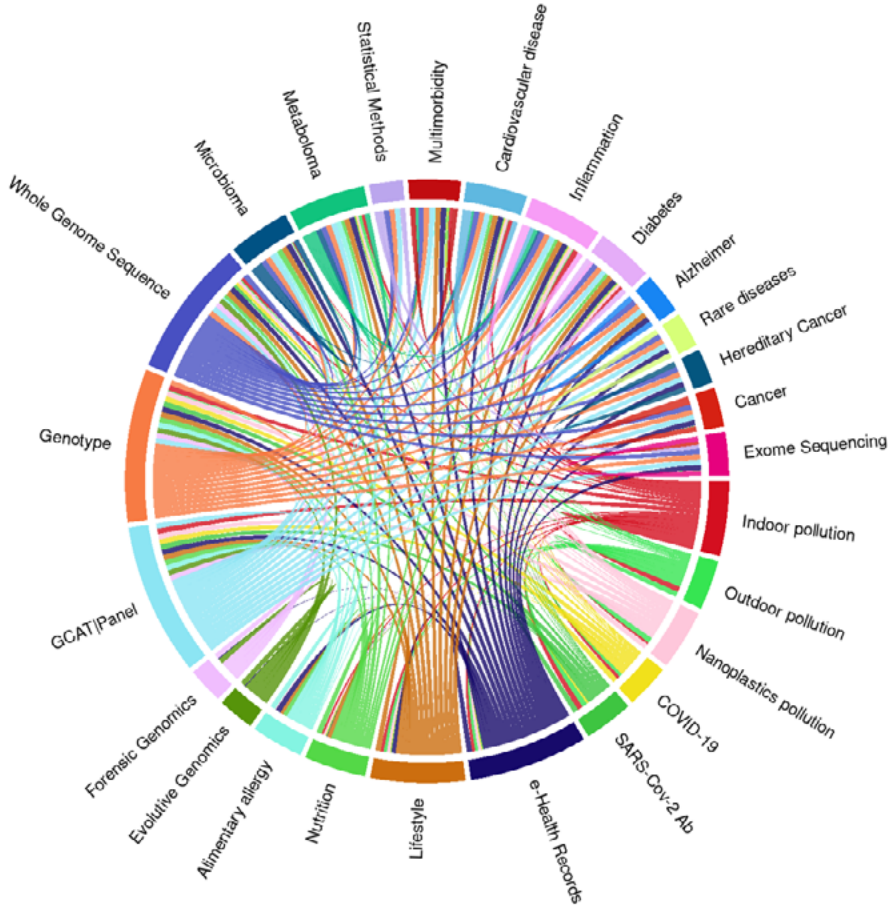


GCAT|GENOMES FOR LIFE PROJECT

"The GCAT is a population-based multi-purpose cohort study set up to identify genomic, epigenomic and environmental factors in the development of multi-factorial chronic diseases"

With the setting up of the GCAT in 2013 the IGTP opted for a stake in genomics medicine. In 2020 the cohort showed its adaptability by joining international consortia working on Covid-19 and contributing to major publications. In 2021 the cohort profile was published in the British Medical Journal Open and the GCAT published the first results of a range of projects.

The research team of the cohort is collaborating on projects in diverse health areas, such as cardiology, response to infectious disease including Covid-19, the effects of environmental factors such as noise, pollution and light on health and, of course, cancer.

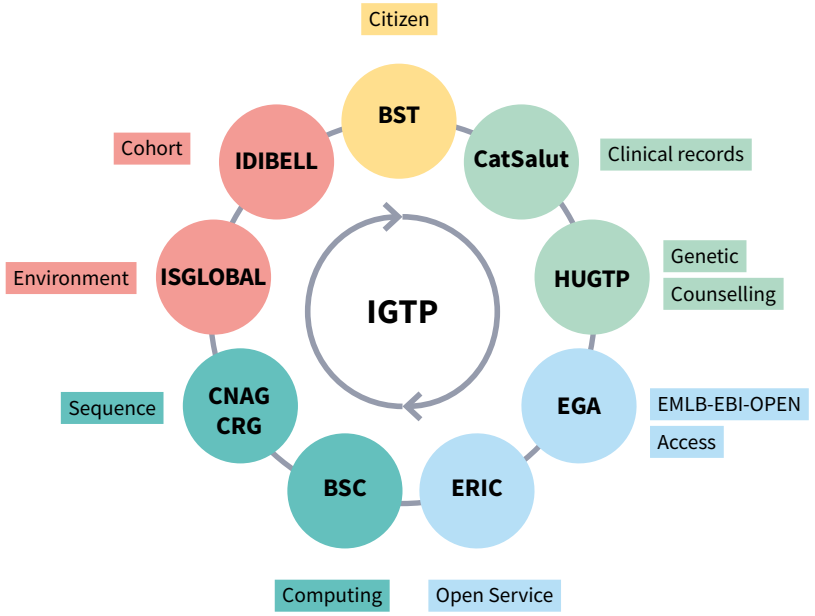


Current Scientific Collaboration Domains of GCAT 2018-2021

In 2021 the GCAT is working with many organizations in Catalonia to collect and analyze data to inform on a wide range of factors impacting health, such as: demographics, diseases & symptoms, family health, lifestyle & environment, medical treatment, mental health, nutrition, physical state, reproduction & development, wellbeing & subjective health, and secondary & linked variables.

Future projects include implementing magnetic resonance imaging (MRI) mapping of GCATcore to map genetic endophenotypes for neurological and psychiatric disorders associated with ageing, implementing a nested cancer cohort and contributing to a population genomic reference cohort of at least 500,000 citizens across Europe (GoEurope).

The GCAT Environment



This data is available to international researchers within the requirements of European Open Science guidelines through the European Genome-Phenome Archive, the Elixir Interoperability Platform and Beacon services, which ensure confidentiality of participants and use of data under the FAIR standards (**F**indability, **A**ccessibility, **I**nteroperability, and **R**euse of digital assets).

GCAT Highlights for 2021

- Consolidated Research group-AGAUR, SGR (2017-2020) (Coordinator. 2021- 2024)
- 11 Projects open
- 2 projects as principal investigator: FIS 2019-2022 / La Marató TV3 (Coordinator) 2022-2023
- 9 Project Partnerships: (ISCIII, H2020, HE), IMPACT, EXaMINA, EXPANSE, VEIS, CONTENT, COVICAT, AIRNEEDS, EnvironME, FIGH-SARS

GCAT Highlighted Publications

Obón-Santacana M, Vilardell M, Carreras A, et al. **GCAT|Genomes for life: a prospective cohort study of the genomes of Catalonia**. BMJ Open 2018;8:e018324. doi: 10.1136/bmjopen-2017-018324

COVID-19 Host Genetics Initiative. Mapping the human genetic architecture of COVID-19. *Nature* 600, 472–477 (2021). https://doi.org/10.1038/s41586-021-03767-x

Kogevinas, M, et al. Ambient Air Pollution in Relation to SARS-CoV-2 Infection, **Antibody Response, and COVID-19 Disease: A Cohort Study in Catalonia, Spain (COVICAT Study).** Environmental Health Perspectives, 17 November 2021. CID: 117003 https://doi.org/10.1289/EHP9726

THE CENTRE FOR COMPARATIVE MEDICINE AND BIOIMAGE (CMCiB)

A high-technology oriented biomedical research facility providing support to all medical fields in the areas of: Advanced Surgery, Imaging Diagnosis and Post-processing, Alternative Methods for Preclinical Research and Pathogen-free BSL3 for Preclinical Models.

In another strategic move to become a key player in preclinical research, the IGTP finalized the construction of the CMCiB in 2018. The second phase of the building and opening of the Bioimaging Department took place in 2019, allowing this project to also make important contributions to Covid-19 research.

In 2021 The CMCiB entered a phase of establishing itself as a quality supplier of services with courses in robotic surgery increasing considerably. Other milestones included: licensing for experimental MRI in humans, certification for use of Type 1 genetically modified organisms and successful completion of the process for certification in Good Laboratory Practices in tandem with the company iVascular.

One hundred and twenty-six courses were held at the CMCiB and 252 surgeons were trained in Colorectal, bariatric, thoracic, gynecological and urological surgery. Eight courses were held in cardiac hemodynamic and neurological interventions in which 58 professionals were trained. The CMCiB is participating in 3 European Projects (Triankle, Tiny Brains, Senso eAXON) and carrying out joint projects with the Germans Trias i Pujol Hospital on lung transplants and renal regeneration.

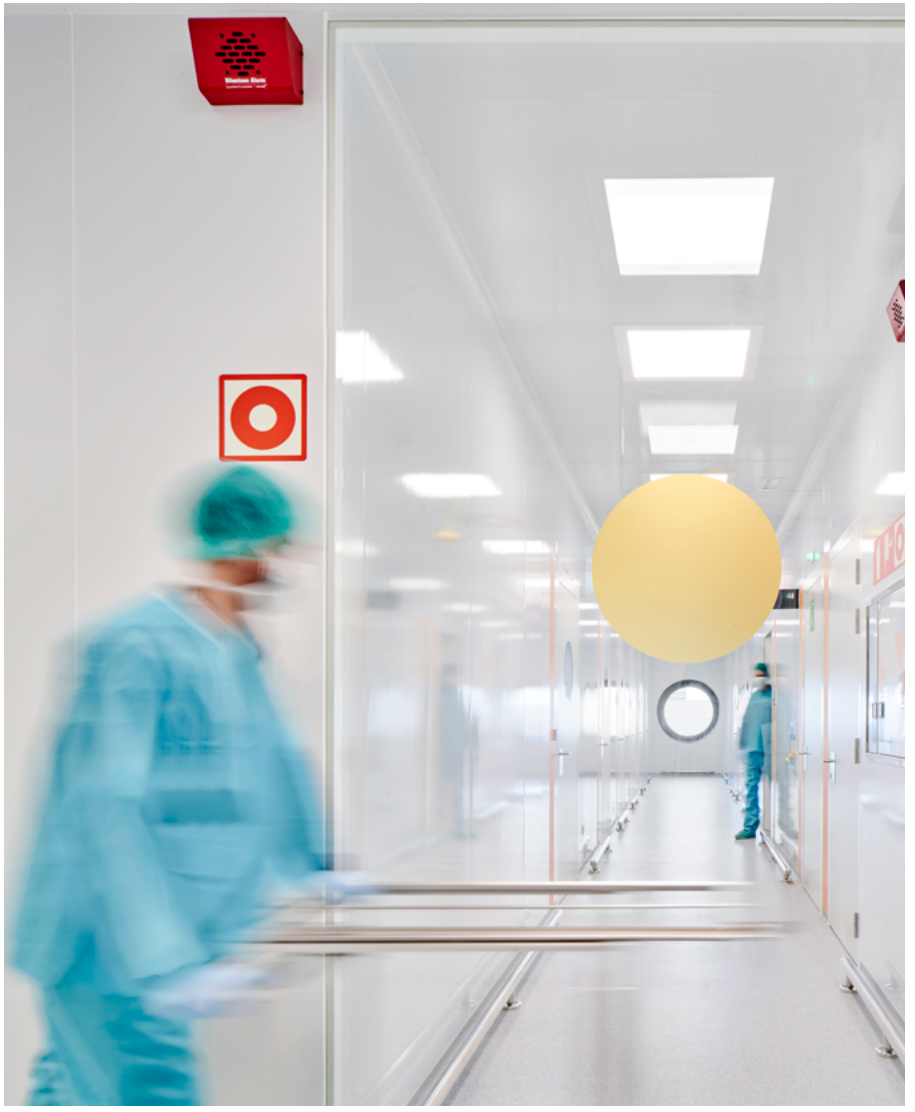
CMCiB Projects and Highlights 2021

HIGHLIGHTS ACCREDITATIONS AND PARTNERING

- BPL059CAT Good Laboratory Practices certificate for the validation of medical devices
- Certification for use of Type 1 genetically modified organisms A/ES/21/103 and A/ES/21/11
- CMCiB enters evaluation phase II for entry into the *Mapa Español ICTs Red Distribuida de Imagen Biomédica (ReDIB)*
- CMCiB signs and agreement with the Fundació Clinic of Hospital Clinic Barcelona for surgical training using the DaVinci technology

HIGHLIGHTS IN SURGERY – PORCINE CARDIAC MODEL

- Monguió-Tortajada et al, Bioactive Materials Volume 6, Issue 10, October 2021, Pages 3314-3327. **Local administration of porcine immunomodulatory, chemotactic and angiogenic extracellular vesicles using engineered cardiac scaffolds for myocardial infarction.** https://doi.org/10.1016/j.bioactmat.2021.02.026
- Martínez-Falguera, D., Fadeuilhe, E., Teis, A., Aranyo, J., Adeliño, R., Bisbal, F., Rodriguez-Leor, O., Gálvez-Montón, C. **Myocardial Infarction by Percutaneous Embolization Coil Deployment in a Swine Model**. J. Vis. Exp (177), e63172, doi:10.3791/63172 (2021).



- Martínez-Falguera D, Iborra-Egea O, Gálvez-Montón C. **iPSC Therapy for Myocardial Infarction in Large Animal Models: Land of Hope and Dreams. Biomedicines**. 2021 Dec 5;9(12):1836. doi: 10.3390/biomedicines9121836. PMID: 34944652; PMCID: PMC8698445.

- Amorós S, Gálvez-Montón C, Rodríguez-Leor O, O'Callaghan JM. **A Simple Low-Cost Electrocardiogram Synchronizer**. Sensors (Basel). 2021 Sep 1;21(17):5885. doi: 10.3390/s21175885. PMID: 34502776; PMCID: PMC8434309.

HIGHLIGHTS IN BIOCONTAINMENT I

- Prize for best oral communication in XXXVII Reunió Annual de la Societat Catalana de Nefrologia. **Impacte de la cirugeria bariátrica en la glomerulopatía de l'obsitat en model experimental amb rates Wistar**. Maru Navarro, Marina López, Irina Pey, Anna Oliveira, Paula Rodríguez, Lidia Blay, Rosa Ampúdia, Sara Capdevila, Maria Pilar Armengol.

- III Congreso Interdisciplinar en Genética Humana, Valencia. **Nueva estrategia de terapia génica restablece los déficits neurológicos y cardíacos en dos modelos de ratón de ataxia de Freidreich**. E Balagué, D Cota-González, K Adrián-Campbell, B García-Lareu, M Chillón, J Coll-Cantí, A Bosch, A Matilla-Dueñas.

- Participation in MinD, The Microbiome in Alzheimer's Disease with ACE, IrsiCaixa and IRB Lerida.

- Entry of colonies of genetically modified mice for 14 Principal Investigators of the IJC

HIGHLIGHTS IN COVID-19 AND INFECTIOUS DISEASES

- Perez-Zsolt D, Muñoz-Basagoiti J, Rodon J, Elosua-Bayes M, Raïch-Regué D, Risco C, Sachse M, Pino M, Gumber S, Paiardini M, Chojnacki J, Erkizia I, Muñiz-Trabudua X, Ballana E, Riveira-Muñoz E, Noguera-Julian M, Paredes R, Trinité B, Tarrés-Freixas F, Blanco I, Guallar V, Carrillo J, Blanco J, Telenti A, Heyn H, Segalés J, Clotet B, Martinez-Picado J, Vergara-Alert J, Izquierdo-Useros N. **SARS-CoV-2 interaction with Siglec-1 mediates trans-infection by dendritic cells**. Cell Mol Immunol. 2021 Dec;18(12):2676-2678. doi: 10.1038/s41423-021-00794-6. Epub 2021 Nov 15. Erratum in: Cell Mol Immunol. 2022 Aug;19(8):965-966. PMID: 34782760; PMCID: PMC8591443.
- Lempp, F.A., Soriaga, L.B., Montiel-Ruiz, M. *et al*. **Lectins enhance SARS-CoV-2 infection and influence neutralizing antibodies.** *Nature* 598, 342–347 (2021). https://doi.org/10.1038/s41586-021-03925-1
- Hipra starts clinical trials of the first Spanish vaccine against Covid-19.
- Antonio Barreiro, Antoni Prenafeta, Gregori Bech-Sabat, Mercè Roca, Ricard March, Luis González, Laia Madrenas, Júlia Corominas, Àlex Fernández, Mercè Molas, Júlia Vergara-Alert, Cristina Lorca-Oró, Núria Roca, Leira Fernández-Bastit, Jordi Rodon, Mònica Pérez, Joaquim Segalés, Edwards Pradenas, Silvia Marfil, Benjamin Trinité, Raquel Ortiz, Bonaventura Clotet, Julià Blanco, Jorge Díaz Pedroza, Rosa Ampudia Carrasco, Yaiza Rosales Salgado, Jordina Loubat Casanovas, Sara Capdevila Larripa, Julia Garcia Prado, Jordi Barretina, Marta Sisteré-Oró, Paula Cebollada Rica, Andreas Meyerhans, Laura Ferrer, Elia Torroella. **Preclinical efficacy, safety, and immunogenicity of PHH-1V, a second-generation COVID-19 vaccine candidate based on a novel recombinant RBD fusion heterodimer of SARS-CoV-2.** Preprint on BioARXiv doi: https://doi.org/10.1101/2021.11.22.469117

HIGHLIGHTS IN MATHEMATICAL MODELLING AND 3R

- 10 articles published in 2021
- New Projects started in 2021
- Machine learning for diagnosis of ictus in mice
- Growth models to study renal lesions
- Collection of reports (200) for Covid-19 follow-up in the hospital
- Follow-up reports on the evolution of Covid-19 in Catalonia (together with AQuAS and BIOCOM-SC)
- 318 Follow-up reports on Covid-19 for the European Commission (BIOCOM-SC)

Innovation and Technology Transfer

During 2021 the Innovation and Business Development Unit continued to establish procedures, while accompanying existing and new projects. A work flow and training programme has been put into practice with the Innovation Department at the Germans Trias i Pujol Hospital. Management has formally agreed to start the process to seek certifications in ISO 9001:2015 and UNE 166002:2014 R+D+I Research Management. The IGTP has initiated the process to enter into Evaluation of health technologies for EATRIS and an agreement has been signed with Dr Laura Sampietro of the Hospital Clínic Barcelona to provide training and mentoring during the process.

At the end of 2021 there were 21 projects in the valorisation pipeline, 7 spin-off companies and one due for official foundation in early 2022. The IGTP is also in the process of formalizing an agreement with an eighth company, currently at pre-seed stage, to develop a pulmonary measurement device.

Spin-off Companies of the IGTP

MANREMYC Health first

Tuberculosis treatment neutraceutical
Founded in 2013

aNiling accelerating epigenomics

Accelerating epigenomics
Founded in 2014

innoVex Therapeutics, S.L.

Exosome and extracellular vesicle-based vaccines
Founded in 2014

AHEAD THERAPEUTICS

Autoimmune disease liposome-based platform
Founded in 2017

Biointaxis

Freidreich ataxis gene therapy
Founded in 2018

timeisbrain

Acute ischemic stroke medical device
Founded in 2020

NIMBLE Diagnostics

Stent monitoring device
Founded in 2021

Research areas, groups and programmes at the IGTP

The IGTP as a CERCA institution recognized by the Government of Catalonia has 34 research groups. As an accredited centre of excellence of the *Instituto de Salud Carlos III*, the IGTP coordinates research at six other research centres comprising a total of 95 Groups. The IGTP has 671 contracted and affiliated researches and 309 scientific and administrative support staff.

There are **nine research areas**:

Science of Behaviour and Substance Abuse	Immunology and Inflammation	Cardiovascular and Respiratory Disease
Infectious Diseases	Endocrine and Diseases of the Metabolism, Bones and Kidneys	Diseases of the Liver and Digestive Tract
Cancer	Neuroscience	Community Health

There is **one transversal programme**:

Translational Program in Cancer Research (CARE)

Team

Science of Behaviour and Substance Abuse

Clinical Pharmacology of Substance Use Disorder
Magin Farre Albalejo

Medical Complications of Substance Abuse
Robert Muga Bustamante

Clinical Pharmacology of Substance Use Disorder

Group Leader: Magin Farre Albalejo

The objectives of the group are to study the acute and chronic pharmacological and toxic effects caused by substance abuse in humans. The members of the group are mostly physicians at the Germans Trias i Pujol Hospital responsible for daily patient care.

The three main active research lines are: 1) Evaluation of the acute effects of new psychoactive substances such as synthetic cathinones (such as mephedrone, methylone and alpha-PVP, MDPV) and synthetic cannabinoids; 2) Evaluation of the acute and chronic effects of binge alcohol consumption in young people and its combination with energy drinks and 3) Evaluation of the effects of cannabis and its components, including its possible therapeutic use (medicinal cannabis). In all three lines, this evaluation includes pharmacodynamics, pharmacokinetics and metabolic aspects and biomarkers associated with consumption.

Medical Complications of Substance Abuse

Group Leader: Robert Muga Bustamente

The group researches the medical consequences of substance use disorder, although group members increased their clinical duties during the COVID-19 pandemic. It is a consolidated 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 -PCAVI- VH.

Immunology and Inflammation

Immunology of Diabetes
Marta Vives-Pi

Immunopathology
Eva Maria Martínez Cáceres

Immunology of Diabetes

Group Leader: Marta Vives-Pi

The multidisciplinary Immunology of Diabetes Group at the IGTP is part of the Immunology Section of the Germans Trias i Pujol University Hospital (HUGTiP). 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 remission and biomarkers.** Their 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.

Immunopathology

Group Leader: Eva Maria Martínez Cáceres

The Immunopathology group of the Germans Trias i Pujol Research Institute is a multidisciplinary team of immunologists, pharmacists, biologists, biochemists and biotechnologists working in various **aspects of immunopathology, in particular on the study of immunological tolerance mechanisms and how their failure causes disease**. The research team is led by Dr Eva Martínez Cáceres, Head of the Immunology Division and Associate professor of Immunology at the Universitat Autònoma de Barcelona. The team members carry out their research in the Immunology Department, Germans Trias Hospital, and the Germans Trias i Pujol Research Institute (IGTP). The team has numerous national and international collaborations and is one of the European Centres of Excellence recognized by the International Federation of Clinical Immunological Societies (FOCIS).

The eminently translational team has extensive experience of more than 20 years in the study of tolerance mechanisms, immunotherapy and immune monitoring. The group has an important line of research based on the analysis of disease biomarkers of response to immuno- modulatory treatments, mainly in multiple sclerosis, reflected in numerous publications.

Cardiovascular and Respiratory Disease

Heart Disease Research

Group Leader: Antoni Bayés Genís

The Program has five main coordinated research lines, it maximizes 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 disco- very 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 been created to find out the **underlying molecular mechanisms of cardiometabolic diseases**.

Infectious Diseases

Clinical and Environmental Infectious Diseases Study Group (CEID)
Maria Luisa Pedro-Botet

Clinical and Experimental Microbiology
Pere Joan Cardona Iglesias

Clinical Virology and New Diagnostic Tools Group
Elisa Martró Català

Experimental Tuberculosis Unit (UTE)
Cristina Vilaplana Masseguer

Innovation in Respiratory Infections and Tuberculosis Diagnosis
Jose Antonio Domingo Benitez

Plasmodium vivax and Exosome Research (PVREX)
Hernando del Portillo Obando

Clinical and Environmental Infectious Diseases Study Group (CEID)

Group Leader: Maria Luisa Pedro-Botet

The CEID is a multidisciplinary group of medical staff at the Germans Trias i Pujol University Hospital and researchers based at the Germans Trias i Pujol Research Institute. Their work covers a range of strategies to prevent and combat infectious diseases. The group is a member of the the CIBEres Network (Centro de Investigación Biomédica en Red en Enfermedades Respiratorias). Research is divided into six research lines.

1. **Infectious endocarditis**: Prospective data- base of diagnosis and follow-up of patients with infectious endocarditis admitted to the Hospital. EnteroColonus GAMES Project and collaboration in the validation of the Poët study.
2. **Primary immunodeficiencies**: Monitoring and/or treatment of more than 150 patients diagnosed with primary immunodeficiency and 30% are receiving replacement treatment. Research into diagnostic and prognostic markers and reducing time to diagnosis.
3. **One Health**: Research dedicated to multidrug-resistant microorganisms involved in animal-human-animal transmission and with special dedication to methicillin-resistant Staphylococcus aureus (MRSA) CC398.
4. **Legionella**: Long-established research line; the hospital is a Reference Laboratory of the General Directorate of Public Health of Catalonia for the Study of Legionellosis outbreaks. We have a patent developed for the Research rapid detection of Legionella in environmental waters and the study of biocides.

5. **Nosocomial infections**: Control and prevention of nosocomial infection (CD, surgical infection) and in particular nosocomial pneumonia. Nosocomial pneumonia out- side intensive care units involves research into the risk factors for nosocomial pneumonia.
6. **Emerging infectious diseases**: into diseases becoming more relevant in Spain such as Chagas disease and Schistosomiasis.

Clinical and Experimental Microbiology

Group Leader: Pere Joan Cardona Iglesias

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 anti- microbial 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** through whole genome sequencing has also been applied to pathogens of public health interest, such as *Mycobacterium tuberculosis* (as reference centre in Catalonia) or SARS-CoV-2, for surveillance purposes and especially for the characterization of outbreaks.

Due to its daily clinical services in the hospital the group aims to be the reference for the "pathogen view" on the campus. It has a strong history of collaborations connecting the essential triangle of healthcare, research and education. The objective is to be a reference group for innovation and tech-transfer activities.

Clinical Virology and New Diagnostic Tools Group

Group Leader: Elisa Martró Català

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 North Metropolitan Area (LCMN) of the Germans Trias i Pujol University Hospital. It is part of a consolidated SGR AGAUR group and belongs to Group 27 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 HCV and HBV 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 and monitored its spread. Additional surveillance of patients and healthcare workers continued in 2021.

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 at the Microbiology Department.

Experimental Tuberculosis Unit (UTE)

Group Leader: Cristina Vilaplana Masseguer

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 (HUGTIP) 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 Cristina 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 and clinical studies and trials
3. **Study of Health dimensions and quality of life** in the context of infectious diseases

Innovation in Respiratory Infections and Tuberculosis Diagnosis

Group Leader: Jose Antonio Domingo Benitez

The research team is a multidisciplinary group that includes basic and clinical researchers, who have been working together uninterruptedly in recent years on research activities related to **the management of respiratory infections and tuberculosis.** The group is recognized by the AGAUR (Agència de Gestió I Ajuts Universitaris i de Recerca, number 2017 SGR 494).

The research activity is carried out in collaboration and in close coordination with the Departments of Microbiology, Paediatrics, Pneumology, Intensive Care, Emergency and the Prevention and Preventive Medicine Departments at the Germans Trias i Pujol University Hospital. The group also collaborates with national and international groups and, belongs to the national network CIBER Enfermedades Respiratorias (CIBERes) group (CB06/0031), in the research programs for "Infectious respiratory diseases Respiratory tract infections", particularly in the areas of "Tuberculosis" and "Host-pathogen interactions".

The group has received funding from national international and private agencies. The research lines of the group are the following: Host-pathogen interaction, Immune response, Intracellular persistence model, Diagnostic technology innovation, and Novel therapeutic approaches.

Plasmodium vivax and Exosome Research (PVREX)

Group Leader: Hernando del Portillo Obando and Carmen Fernández Becerra

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.

Endocrine and Diseases of the Metabolism, Bones and Kidneys

Diabetes Research Group
Nuria Alonso Pedrol

Endocrine, Thyroid and Obesity
Manel Puig Domingo

Innovation in Vesicles and Cells for Application in Therapy (IVECAT)
F Enrique Borràs Serres

Kidney Affecting Diseases (REMAR)
Jordi Bover Sanjuan

Diabetes Research Group

Group Leader: Nuria Alonso Pedrol

The fundamental clinical issue addressed in this area is the **detection and characterization (phenotypic and molecular) of preclinical atheromatous 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 diabetic retinopathy (DR) and cognitive dysfunction (European project RECOGNIZED). Relevant findings published in recent years are: an increase in subclinical atherosclerosis in patients with DR in the absence of kidney disease; the description of cerebral microvascular disease associated with diabetes; the existence of microangiopathy in the carotid wall in patients with diabetes, and its association with DR; the differential utility of markers of heart failure in diabetes. Recently, a new line of research related to non-alcoholic fatty liver disease (NAL- FD) has been initiated in patients with diabetes in collaboration with two leading national and international groups in NAFLD.

Endocrine, Thyroid and Obesity

Group Leader: Manel Puig Domingo

The IGTP Translational Endocrinology research group (ENDOGRUP- 2017 SGR 1262) is coordinated by Manel Puig Domingo, currently Head of the Endocrinology and Nutrition Service at the Germans Trias i Pujol Hospital (HUGTiP) 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 (-omic) data of thyroid tumors to discover molecular pathways likely to generate new therapeutic targets and also to identify diagnostic and prognostic marker profiles 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.

Innovation in Vesicles and Cells for Application in Therapy (IVECAT)

Group Leader: F Enrique Borràs Serres

The IVECAT group (Innovation in VEsicles and Cells for Application in Therapy) was founded in February 2002, when Francesc E Borràs joined the Immunology Laboratory at the Germans Trias i Pujol University Hospital on the Can Ruti Biomedical Campus, in Badalona. From initial studies on dendritic cells, the group shifted its basic research to “cell-free” models and concentrating on extracellular vesicles as therapeutic players. This research has the ultimate goal of transferring knowledge to Society. To bring this about, the scientific interests of the research group focus on two priority areas of research: 1) the development of new strategies for the improvement in the objective diagnosis of diseases/pathologies and 2) research in the field of preventive and therapeutic cell & “Cell-free” advanced therapies for immunomodulation and regenerative medicine.

The IVECAT group is included within the REMAR Group (from the name in Catalan, REcerca en Malalties d’Afectació Renal, or Kidney Related Diseases Research Group) in a multidisciplinary group including more than 25 professionals from the Germans Trias University Hospital (HUGTP) and the IGTP - including doctors, biologists, veterinarians, biochemists and biotechnologists. The group was recognized as an emerging group (2014SGR804) and as a Pre-consolidated group (2017SGR301) by the Government of Catalonia.

Kidney Affecting Diseases (REMAR)

Group Leader: Jordi Bover Sanjuan

The REMAR group (REcerca en Malalties d'Afectació Renal) or Kidney Related Diseases Research Group is a multidisciplinary group of medical professionals from the Germans Trias University Hospital (HUGTP) and researchers from the Germans Trias i Pujol Research Institute (IGTP). The group was recognized as an emerging group (2014SGR804) and as a Pre-consolidated group (2017SGR301) by the Catalan Government.

The team aims to carry out **basic, clinical and translational research in the field of kidney diseases and disorders associated with kidney failure.** Our research lines are focused in identifying non-invasive biomarkers and developing innovative therapies for kidney-related diseases.

Diseases of the Liver and Digestive Tract

Childhood Liver Oncology c-LOG
Carolina Armengol Niell

Digestive Inflammatory Pathology
Eugeni Domènech Morral

Translational Research in Hepatic Diseases
Rosa Maria Morillas Cunill

Innate Immunity
Maria Rosa Sarrias Fornes

Childhood Liver Oncology c-LOG

Group Leader: Carolina Armengol Niell

The main goals of this pioneering group focusing on translational research into pediatric 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 Tumor Trial (PHITT). The CLCN collection is the basis of 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.

Digestive Inflammatory Pathology

Group Leader: Eugeni Domènech Morral

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 AdQualitatem Foundation.

The main lines of research of the group are:

1. **Characterization and treatment safety/efficacy**
2. **Postoperative recurrence in Crohn's disease**
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.

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.

Translational Research in Hepatic Diseases

Group Leader: Rosa Maria Morillas Cunill

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 collaborative projects within organizations such as: the *Societat Catalana de Digestología (ACD)*; the *Associación 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 is a member of the working group Prevention and Teatmentof the Complications of Chronic Liver Disease (GTiPUH), which is part of the National Network of Research in Hepatology and Gastroenterology (RNIHG).

Innate Immunity

Group Leader: Maria Rosa Sarrias Fornes

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 centred 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.** Combining basic, translational and innovation approaches this line is mostly centred on understanding liver disease, within the CI- BERehd consortium. We are developing a novel immunotherapy to target macrophages in cancer in collaboration with Dr Alhelí Rodriguez (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 co- vid-19 pandemic.

2. **Generation of novel in vitro diagnostic tests** 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.** This new line of re- search started in 2020 thanks to the award of a collaborative FIS project with Dr Masnou of the Department of Gastroenterology, HUGTiP.

Cancer

Badalona Applied Research Group in Oncology (B·ARGO)
Ricard Mesia Nin

Cancer Genetics and Epigenetics
Sergio Alonso Utrilla

Clinical Genomics Research
Elisabeth Castellanos Perez

Endocrine Tumors
Mireia Jordà Ramos

Epigenetics of Cell differentiation and Cancer
Miguel Angel Peinado Morales

Hereditary Cancer
Eduard Serra Arenas

Molecular and Structural Pathology
Pedro Luís Fernández Ruiz

Resistance, Chemotherapy and Predictive Biomarkers
Eva Martinez Balibrea

Badalona Applied Research Group in Oncology (B·ARGO)

Group Leader: Ricard Mesia Nin

B · ARGO is a 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 re-searchers, 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**

Cancer Genetics and Epigenetics

Group Leader: Sergio Alonso Utrilla

The group studies tumors from the intestinal tract (i.e. colon, and stomach) that sometimes develop when the cell machinery preserving the integrity of the genome is not working properly. When these corrector genes (mutators) are inactivated, the mutations that occur in all normal cells accumulate in large numbers because they are not repaired. This originates a remarkable genomic instability and cancer eventually develops when mutations occur in some cancer genes, such as the oncogenes and tumor suppressor genes. Some of the mutator genes are not inactivated by mutations (mutator mutations) but by epigenetic silencing. This results as a consequence of the disintegration of the epigenetic code, an unexplored process that is strongly associated to aging. These studies have clinical applications. For instance, many hereditary colon tumors originate by mutations in mutator genes that are transmitted from generation to generation. Molecular diagnosis of the deficient mutator genes determines which members of these families will be affected in the future. Identification of tumors with this kind of genomic instability is also useful to detect familial cancer patients and to predict survival.

Clinical Genomics Research

Group Leader: Elisabeth Castellanos Perez

This group is made up of medical staff and researchers of the Germans Trias i Pujol University Hospital and the IGTP. It is dedicated to **improving the diagnosis and treatment of the RASopathies.**

The team has improved the custom panel developed in 2015 to genetically diagnose the RASopathies (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.

Ignacio Blanco leads 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 and the team have participated in the identification of genetic susceptibility factors to SARS-CoV-2, the study of the mechanisms of transmission through species and the identification of possible treatments (Revollo et al 2020) among others.

Endocrine Tumors

Group Leader: Mireia Jordà Ramos

The group seeks to better understand the **molecular landscape of thyroid cancer and pituitary tumors.** 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 tumors in collaboration with the Endocrinology Service at the Germans Trias i Pujol University Hospital. 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.

Epigenetics of Cell Differentiation and Cancer

Group Leader: Miguel Angel Peinado Morales

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
- The role of repeat elements in genome structure and function
- Clinically oriented research on the epigenetic changes involved in human cancer
- Genomic Medicine Technological Innovation

Hereditary Cancer

Group Leader: Eduard Serra Arenas

Neurofibromatosis type 1 (NF1) is a genetic disease with an incidence at birth of 1:3000. NF1 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 NF1 patients with high tumor burden is complex.

This 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. The group seeks 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, the research centres on the development of more effective therapeutic strategies.

Molecular and Structural Pathology

Group Leader: Pedro Luís Fernández Ruiz

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), in 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.

Resistance, Chemotherapy and Predictive Biomarkers

Group Leader: Eva Martinez Balibrea

This group focusses on the **molecular processes through which tumor cells develop resistance to chemotherapy during the treatment of patients with colorectal cancer (CRC) and melanoma (MLN)**. By identifying the factors responsible for this chemoresistance, the researchers **aim to discover biomarkers** that will improve the selection of effective treatments for patients and also lead to the development of new therapeutic strategies. To achieve these goals work centres on studying cell models of acquired resistance and the analysis of gene or protein expression patterns as well as looking for common genetic variants in genes that may be involved in the action of chemotherapy agents. This work is carried out using blood and/or tumor samples. The global objective is to **optimize treatment to achieve a better prognosis and improve quality of life for patients.** The group is part of the research program ProCURE (PROgram against Cancer REsistance) from the Catalan Institute of Oncology (ICO). Eva Martinez-Balibrea is a member of the PREDVHICO (2014 SGR 1494), which is a recognized stable research group by the Generalitat de Catalunya. The group participates in several training courses in oncology every year.

Neuroscience

Cellular and Molecular Neurobiology (CMN)
Teresa Gasull Dalmau

Genomics and Transcriptomics of Synucleinopathies
Katrin Beyer

Neurogenetics
Antoni Matilla Dueñas

Neuromuscular and Neuropaediatric Research
Gisela Nogales Gadea

Vascular Pathologies of the Brain
Antoni Dávalos

Cellular and Molecular Neurobiology (CMN)

Group Leader: Teresa Gasull Dalmau

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 antiferroptotic 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 gyrencephalic, human-like, swine brain.** Models of stroke damage in gyrencephalic brains, with a special focus on da- mage of the white matter and brain areas connectivity.
4. **Discovery of new biomarkers to improve stroke treatment.** Discovery of new biochemical and bioimaging biomarkers useful to address point of care stroke type identification, stroke patient stratification, patient se- lection for treatment allocation and/or out- come prediction.
5. **Computational biology and machine/deep learning neurobehavioural assessment for the prediction of brain damage and neurological outcome in in vivo stroke models.** Development of in silico machine/deep learning methods for the neurological analysis of behaviour in stroke models, with predictive value of brain damage and outcome.

Genomics and Transcriptomics of Synucleinopathies

Group Leader: Katrin Beyer

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 both so-called Lewy bodies develop in vulnerable brain areas. The two diseases have 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 ad- verse reactions to the treatment administered, which irreversibly worsens their condition.

The GTS group focuses on the **genetic characterization of DLB,** which was only described as a separate disease 20 years ago. The group is searching for peripheral biomarkers and is looking at one to monitor the treatment with possible anti-alpha-synuclein aggregation therapies in DLB, and one for patient stratification.

Currently, the latter two are being further developed to provide useful tools for application in clinical practice. The latest findings indicate that specific blood cells may be directly involved in DLB pathogenesis. Consequently, this research topic has become one of their main objectives.

- **Genetic characterization of DLB.** DLB-specific genetic variations in brain; functional analyses of promoter, intronic and 3'UTR variants. Expression and alternative splicing analysis of DLB genes in brain; confirmation in peripheral sources (blood, saliva). Analysis of miRNA expression changes in brain and blood.
- **Biomarker search.** Identification of biomarkers for the diagnosis/differential diagnosis of DLB from peripheral sources (whole blood, plasma, platelets, saliva). Study of platelet dysfunction in DLB: identification and characterization of disease specific platelet activation pathways; study of mitochondria function, apoptosis induction pathways and platelet-immunoreceptor profile.

Neurogenetics

Group Leader: Antoni Matilla Dueñas

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 gene- tic 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.

By combining some of these approaches, the group has recently identified 2 novel ataxia subtypes and characterised their gene pro- ducts 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, they have developed an AAV-gene therapy for Friedreich's ataxia that has proven safe and long-term efficient in 2 different mouse models of the disease.

Neuromuscular and Neuropaediatric Research

Group Leader: Gisela Nogales Gadea

The main focus of the multidisciplinary team is finding treatments for neuromuscular and neuropediatric diseases that currently have no cure. The laboratory is focussing on the following specific topics at the moment:

- **DIMINUTES, Childhood and adult myotonic dystrophy:** evaluation of new treatments and pathogenicity through genetic, epigenetic and molecular imaging analysis (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 I** (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 I** (A.Ramos)

Vascular Pathologies of the Brain

Group Leader: Antoni Dávalos Errando

The research area of cerebral vascular pathology at the Germans Trias Institutewas set up in 2005 and is led by Antoni Dvalos, 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.

Community Health

Global health and Epidemiology of STDs (CEEISCAT)
Jordi Casabona Barbara

Research and Innovation in Nursing Care
Cristina Casanovas

Global health and Epidemiology of STDs (CEEISCAT)

Group Leader: Jordi Casabona Barbara

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 (PCAVIHV) 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 PCAVI- 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.

CEEISCAT has been recognized by the Catalan Agency for Management of University and Research Grants (AGAUR) as a consolidated research group since 2006 and together with the Microbiology Service of the Germans Trias Hospital, it constitutes a Node (Group 27) in the Network of Excellence in Epidemiology and Public Health (CIBERESP).

Research and Innovation in Nursing Care Group

Group Leader: Cristina Casanovas

The Research and Innovation in Nursing Care Group was set up formally in early 2021 to provide support and increase the effectiveness of research into nursing care across the services of the Germans Trias i Pujol University Hospital.

The group works on projects from the planning phase to the science dissemination and popularization phases. The aim is to **promote research of excellence nursing and to increase the quantity and quality of formal studies undertaken in the hospital in this field.**

The group provides support at all levels, from ensuring correct planning, selection of methodology, authorizations, grants through to pilot studies, the adaption of forms and creation of data bases and finally including the production of reports or publication of studies. The studies include those promoted by the hospital and external promotors, most of the studies undertaken are linked to doctoral theses, or masters' dissertations.

Translational Program in Cancer Research (CARE)

The institute continues working to structure research into programmes to accommodate the many translational projects that traverse several research areas.

With the entry of new groups working on cancer, the IGTP has restructured its cancer programme initially set up when the Institute of Predictive and Personalized Medicine of Cancer (IMPPC) was incorporated as the Programme for Predictive and Personalized Medicine of Cancer (PMPPC).

The new programme, named the Translational Program in Cancer Research (CARE) comprises:

1) Program Management, including a clinical research director and a basic research director.

2) Program Coordination, including a scientific Coordinator, educational & training coordinator and a networking coordinator. Initially there are 17 core research groups and 8 joint research groups.

CORE INSTITUTIONS

IGTP

Catalan Oncology Institute (ICO)

Germans Trias i Pujol Hospital

POTENTIAL ASSOCIATED CENTRES

IrsiCaixa

Fight Infectious Diseases Foundation (FLS)

Banc de Sang i Teixits (BST)

IDIAP Jordi Gol Foundation

Maresme Health Consortium

Universitat Autònoma de Barcelona (UAB)

IGTP Affiliated Groups Distributed by Institution

Maresme Health Consortium (CSdM)

Communication and Health (ComSal)
Carol Palma

Disorders of Digestive and Anorectal Motility and Pelvic Floor Pathologies (TMCAR)
Lluís Mundet

Maresme Study Group on Pneumonias Acquired in the Community (GEMPAC)
Ramon Boixeda

Neurogastroenterology and Motility Research Group
Pere Clave

Psycho-neuroendocrinology and Stress in Psychosis (PSICPNEC)
Javier Labad

Sarcopenia, Fragility and Dependence (GRESFD)
Mateu Serra

Sepsis, Inflammation and Safety in Critical Patients (SIS)
Amparó Bodí

IDIAP Jordi Gol Foundation

Peripheral Arterial Pathology and Cardiovascular Risk (ARTPER)
Maite Alzamora

Osteoarticular Diseases (GROIMAP)
Rafael Azagra

Hepatic Diseases (GREMHAP)
Llorenç Caballera

Sexual and Reproductive Health (GRASSIR)
Gemma Falguera Puig

Health and Society (GREMSAS)
Maria Mercedes Jiménez González

Healthy Ageing (GRIDAES)
Pilar Montero Aliá

Chronic Respiratory Disease (GRECMAR)
Pere Toran Montserrat

Primary Healthcare Research Group
Concepció Violan Fors

Fight Infectious Diseases Foundation (FLS)

Aging and Chronicity
Eugènia Negredo Puigmal

Brain Function, Emotion and Behaviour
Jose Muñoz Moreno

Dietetics
Carla Estany Quera

Hepatitis and Liver Pharmacology
Josep Maria Llibre Codina

PrEP
Pablo Rodriguez Coll

Vaccines, Immunotherapy and Pharmacology
Beatriz Mothe Pujadas

Guttmann Institute

Neural Repair and Advanced Therapies
Joan Vidal Samso

Neuropsychological Rehablititation and Cognitive Stimulation (GNPT)
Alberto Garcia Molina

Neurostimuation and Neuromodulation
Raul Pelayo Vergara

Social Investigation - QVIDLAB
Joan Saurí Ruiz

Technologies for Sensorimotor Rehabilitation and Support Products
Eloy Opisso Salleras

IrsiCaixa AIDS Research Institute

Cell Virology and Immunology (VIC)
Julian Blanco

HIV and HCV Genetic and Phenotypic Variability
Miguel Angel Martinez

Host Genetics and Cell Immunity
Christian Brander

Immunology (IGG)
Jorge Carrillo

Microbial Genomics
Roger Paredes

Neogantigens and Therapeutic Vaccines for Cancer (NeoVaCan)
Iglesia Núria

Pathogen Immunity, Signalling and Therapeutic Applications (PISTA)
Nuria Izquierdo

Retrovirology and Clinical Studies (GREC)
Javier Martinez

Tissue Virology (VTI)
Cecilia Cabrera

Translational Research in Immunology and Ageing (TRIA)
Marta Massanella

Viral Immune Evasion an dVaccines (VIRIEVAC)
Julia Garcia

Virus-Host Interactions (ViHIT)
Ester Ballana

Josep Carreras Leukaemia Research Institute (IJC)

3D Chromatin Organization
Maria Martinez Biola

Acute Lymphoblastic Leukemia (ALL)
Maria Santasusana Josep

Barcelona Endothelium Team
Enric Carreras Pons

Cancer Epigenetics
Manel Esteller Badosa

Cancer Genetics
Montse Sanchez Cespedes

Cancer Heterogeneity and Hierarchies
Verónica Rodilla Benito

Cancer Immunogenomics
Eduard Porta Pardo

Cellular Systems Genomics
Elisabetta Mereu

Chromatin Biology Laboratory
Alejandro Vaquero García

Chromatin, Metabolism and Cell Fate
Marcus Buschbeck

Endothelial Pathobiology and Microenvironment
Mariona Graupera

Epigenetic Control of Haematopoiosis
Luis Ortega José

Epigenetic Therapies
Maria Berdasco Menendez

Epigenetics and Immune Disease
Esteban Ballestar Tarin

Immunohematology and Glycobiology
Fumiichiro Yamamoto

Leukemia and Immuno-Oncology
Laura Belver Miguel

Leukemia Stem Cell Group
Ruth Muñoz Risueño

Lymphocyte Development and Disease
Isabel Bola Maria

Lymphoid Neoplasms
Tomas Ferrando Ferrando

Lymphoma Translational group
Gaël Roué

Multiple Myeloma
Albert Oriol Rocafiguera

Myelodysplastic Syndrome
Francesc Sole Ristol

Myeloid Neoplasms
Lurdes Zamora Plana

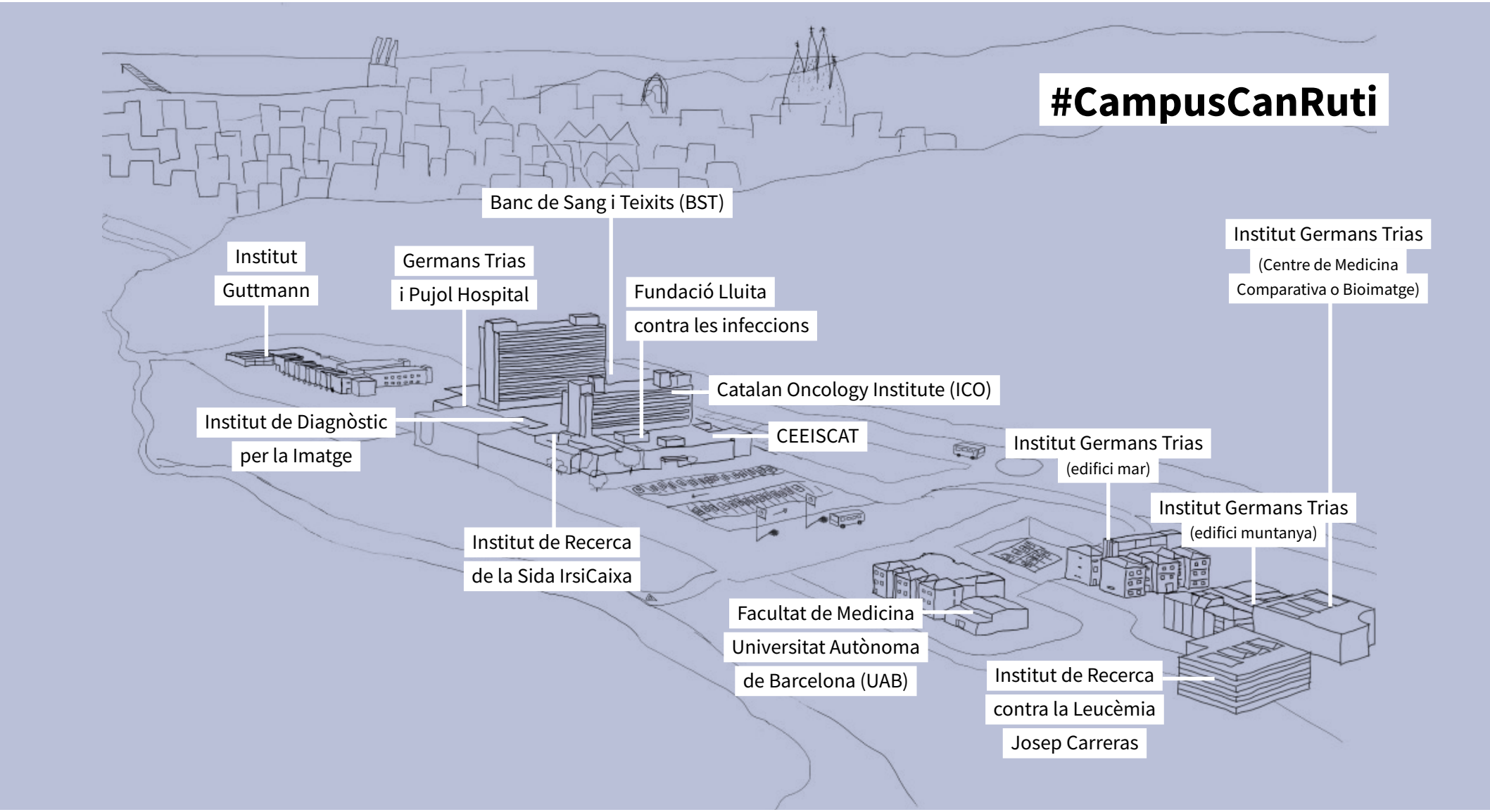
Regulatory Genomics
Tania Vavouri

Regulatory RNA and Chromatin
Sònia Guil Domènech

Stem Cell Biology, Developmental Leukemia and Immunotherapy
Pablo Menendez Bujan

T-cell Lymphoma
Laura Mondragón

Transcriptional Dynamics of Leukaemia
Sergi Cuartero Betriu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Banc de Sang i Teixits (BST)
Institut Guttmann
Germans Trias i Pujol Hospital
Fundació Lluita contra les infeccions
Institut Germans Trias (Centre de Medicina Comparativa o Bioimatge)
Catalan Oncology Institute (ICO)
Institut de Diagnòstic per la Imatge
CEEISCAT
Institut Germans Trias (edifici mar)
Institut Germans Trias (edifici muntanya)
Institut de Recerca de la Sida IrsiCaixa
Facultat de Medicina Universitat Autònoma de Barcelona (UAB)
Institut de Recerca contra la Leucèmia Josep Carreras

Carretera de Can Ruti, Camí de les Escoles s/n
08916 Badalona, Barcelona, Spain
(+34) 93 554 3054
www.germanstrias.org
Design: ondeuev.net