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# ANNUAL REPORT 2020

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The Electrophysiology  
and Heart Modeling  
Institute

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## ABOUT LIRYC

**Liryc is a unique institute entirely dedicated to heart rhythm diseases. These rhythm disorders are associated with many cardiovascular diseases, which account for almost a third of the deaths worldwide.**

Liryc is one of the seven University Hospital Institutes (IHU) created by the French government as part of the Investments for the Future Program, with the objective of energizing medical research and innovation in France.

To take on this major public health challenge, Liryc is committed to 4 missions: research, innovation, patient care and training. The objective is to better understand the mechanisms at the origin of these diseases, to develop therapeutic, diagnostic and preventive tools in order to treat the patients and to diffuse the acquired knowledge to the largest possible number of centers throughout the world.

Liryc brings together researchers, doctors and engineers within the same institute for the benefit of patients. The international multidisciplinary experts strive every day to better understand and treat heart rhythm diseases which are:

- **atrial fibrillation**, the most common arrhythmia affecting nearly 33 million individuals in the world,
- **ventricular fibrillation**, the main cause of 4.25 million sudden cardiac deaths per year worldwide, which is 10% of the deaths in Western societies,
- **heart failure** which affects 26 million people in the world.

In a unique technological environment and a dynamic ecosystem, Liryc aims **to revolutionize the treatments and the prevention of heart rhythm diseases for the direct benefit of the largest number of people worldwide.**

More information on [www.ihu-liryc.fr](http://www.ihu-liryc.fr)

## A MESSAGE FROM A FOUNDING MEMBER

**During the past six years, the Liryc IHU (University Hospital Institute) has been focusing the expertise of scientists and practitioners from various disciplines on an ambitious research and innovation program. Its results place it at the best international level in terms of modeling, experimenting and clinical advances on the heart rhythm diseases.**



**Nicolas Roussel**,  
director of the INRIA  
Bordeaux-South West  
research center

Inria — *National Institute for Research in Digital Science and Technology* — has contributed to Liryc's advances through the research efforts in modeling and technological developments of our project-teams *Carmen* and *Epione* of Bordeaux and Sophia Antipolis.

In 2019, Inria, the University of Bordeaux, the Bordeaux University Hospital Center and the Nouvelle-Aquitaine Region clearly reasserted their commitment for Liryc before an international jury and the French National Research Agency, with new collective momentum and dynamic projects. Then 2020 came...

During this very particular year, we had to deal with unprecedented situations that we managed to handle successfully. I want to congratulate the Liryc teams who got through this year with perseverance and high spirited enthusiasm.

Inria and the French government signed an objective and performance agreement in 2020 to foster the development of major universities, based on joint strategies backed by our specific digital services. In this contract, "digital health" is one of the scientific priority sponsored by the Bordeaux South-West Inria center.

The IHU Liryc is an example of what I would like to continue to develop with the University of Bordeaux and our partners: ambitious (and therefore risky) structuring research and innovation projects, with a major concern for clinical impact.

*Liryc was structured as a scientific cooperation foundation under the aegis of the University of Bordeaux Foundation. Its founding member are the University of Bordeaux, the Bordeaux University Hospital Center, Inria and the Nouvelle-Aquitaine Region. The founding members provide the institute with resources, support its strategic orientation and ensure it functioning. Liryc also has two major academic partners: Inserm and CNRS.*



# 2020 IN FIGURES

 **162** members

 **23** nationalities

 **11.5** €M in expenses

 **997,428** € in collection of gifts

## RESEARCH

**32** projects supported by grants in 2019

**101** clinical trials

**277** scientific publications

## INNOVATION

**18** pending patents

**30** industrial collaboration contracts in progress

**3** start-ups

## PATIENT CARE

**6,492** patients remotely monitored

**5,554** medical consultations / remote consultations

**2,133** interventions

## TRAINING & EDUCATION

**22** Phd student

**240** trained professionals

**8** training sessions and e-training

## A MESSAGE FROM THE PRESIDENT OF THE ADMINISTRATIVE BOARD

### ACCELERATING OUR PROGRESS

The year 2020 was for all a year full of challenges and opportunities. It forced us to rethink our priorities, our work method and our main objectives in a world affected by the COVID-19 health crisis. Health was at the core of all our concerns and medical innovation was expected more than ever worldwide. COVID-19 has underlined the absolute necessity of the health research institutes such as the Liryc Institute.

Despite the complicated context, the Liryc teams pursued their efforts towards good quality care of patients and ongoing research. The institute was ranked in the world's top 10 for cardiac rhythmology research centers, before Stanford and just after Harvard. Innovation and digital transformation also marked this year. The institute undertook the development of its spin-offs and successfully applied digital technologies for the remote monitoring of patients and for training purpose.

The Liryc community is growing every day and I want to congratulate everyone who has joined us this year for the essential support they have provided to go beyond boundaries in the pursuit of preventing heart rhythm diseases.

2021 will be very exciting for Liryc particularly with the kick-off of major European and international research projects in the fields of atrial fibrillation and cardiac modeling, the construction of a cardiac bioengineering platform and the launching of a major fundraising campaign. I want to personally thank all the Liryc teams for their commitment. Our expertises are our most precious assets to successfully take on these new challenges, accelerate our progress and further our missions.



**Michel Vounatsos**, president of the Administrative Board of Liryc



## HEADLINES IN 2020

- **COVID-19 and heart: launching of two clinical studies to measure the risk of occurrence of cardiac arrhythmias in patients with COVID-19.**

- COVID-CMR evaluates the prevalence of silent myocardial scars after infection with COVID-19 and the associated risk of arrhythmias thanks to high-resolution MRI.
- ASCCOVID19 investigates the consequences of coronavirus on the heart of high-level athletes.

The teams also worked with the French Society of Cardiology in developing cardiological recommendations for health professionals in order to prevent arrhythmias or heart function's alterations of the COVID-19 treatments.

- **Advances in the understanding of the mechanisms of atrial fibrillation initiation and maintenance.**

This work enable to identify new therapeutic targets (reactive oxygen species and EPAC proteins), and to develop new ablative approaches by vein of Marshall ethanol infusion.

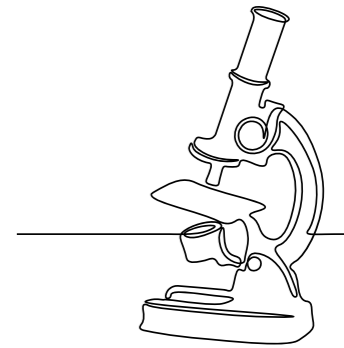
The team also studies the role of aging and that of cell senescence, through the Research Chair of Excellence in atrial fibrillation led by Prof Stanley Nattel, at the Montreal Heart Institute.

- **Revealing new mechanisms of sudden cardiac death linked to specific disorders of conduction or repolarization in the context of certain cardiac pathologies.**

The work of the Research Chair of Excellence in ventricular fibrillation, led by Prof Peng-Sheng Chen, at Indiana University, focuses on the role of the nervous system in triggering arrhythmias.

- **3 European research projects were financed in the framework of the 2020 Horizon program:**

BEAT-AF about atrial fibrillations, MICROCARD and SIMCARDIOTEST in the field of cardiac modeling.



## Top 10

Liryc is ranked in the top 10 international universities in cardiac rhythmology



## HEADLINES IN 2020

### • Development of transverse research tools

The teams also worked on new personalized electromechanical virtual models; new mapping methods and new high-resolution imaging approaches improving the characterization of the cardiac substrate, in particular in the framework of the Research Chair of Excellence in imaging led by Prof Matthias Stuber, at the University of Lausanne.



*A biometric study by the University of Lille\* ranks Liryc in the top 10 international universities in cardiac rhythmology, along with prestigious institutions such as Harvard Medical School and the Mayo Clinic. This ranking reflects the excellence of the work of Liryc's multidisciplinary teams to further understanding of the mechanisms of the heart's electrical activity.*



– **Prof Olivier Bernus**,  
scientific director  
of Liryc

\* Study carried out using the SAMPRa application on the InCites database

## MAJOR PUBLICATIONS IN 2020

- Validating QT-Interval Measurement Using the Apple Watch ECG to Enable Remote Monitoring During the COVID-19 Pandemic. Strik M, Caillol T, Ramirez FD, Abu-Alrub S, Marchand H, Welte N, Ritter P, Haïssaguerre M, Ploux S, Bordachar P. *Circulation*. 2020 Jul 28;142(4):416-418
- Marshall bundle elimination, Pulmonary vein isolation, and Line completion for ANatomical ablation of persistent atrial fibrillation (Marshall-PLAN): Prospective, single-center study. Derval N, Duchateau J, Denis A, Ramirez FD, Mahida S, André C, Krisai P, Nakatani Y, Kitamura T, Takigawa M, Chauvel R, Tixier R, Pillois X, Sacher F, Hocini M, Haïssaguerre M, Jais P, Pambrun T. *Heart Rhythm*. 2020 Dec 29:S1547-5271(20)31218-2
- Impact of Vein of Marshall Ethanol Infusion on Mitral Isthmus Block: Efficacy and Durability. Nakashima T, Pambrun T, Vlachos K, Goujeau C, André C, Krisai P, Ramirez FD, Kamakura T, Takagi T, Nakatani Y, Kitamura T, Takigawa M, Roux JR, Cheniti G, Tixier R, Chauvel R, Welte N, Duchateau J, Sacher F, Cochet H, Hocini M, Haïssaguerre M, Jais P, Derval N. *Circ Arrhythm Electrophysiol*. 2020 Dec;13(12):e008884
- Temperature- and flow-controlled ablation/very-high-power short-duration ablation vs conventional power-controlled ablation: Comparison of focal and linear lesion characteristics. Takigawa M, Kitamura T, Martin CA, Fuimaono K, Datta K, Joshi H, Constantin M, Bourier F, Cheniti G, Duchateau J, Pambrun T, Denis A, Derval N, Sacher F, Cochet H, Hocini M, Haïssaguerre M, Jais P. *Heart Rhythm*. 2020 Oct 27:S1547-5271(20)31032-8.
- Automated rhythm-based control of radiofrequency ablation close to the atrioventricular node: Preclinical, animal, and first-in-human testing. Hooks DA, Dubois R, Meillet V, Nicot J, Berte B, Yamashita S, Mahida S, Sellal JM, Frontera A, Denis A, Sacher F, Derval N, Crozier I, Melton I, Haïssaguerre M, Jais P. *Heart Rhythm*. 2020 Oct 20:S1547-5271(20)30977-2.

## HEART & COVID-19: MEASURE THE RISKS OF ARRHYTHMIAS LINKED TO CORONAVIRUS

**Liryc supported the Bordeaux University Hospital medical teams during the first wave of the epidemic, defining a prevention protocol of the cardiac risks associated with COVID-19 treatments. Liryc then launched in 2020 two research projects aimed at measuring the risks of occurrence of cardiac arrhythmias in patients with COVID-19.**

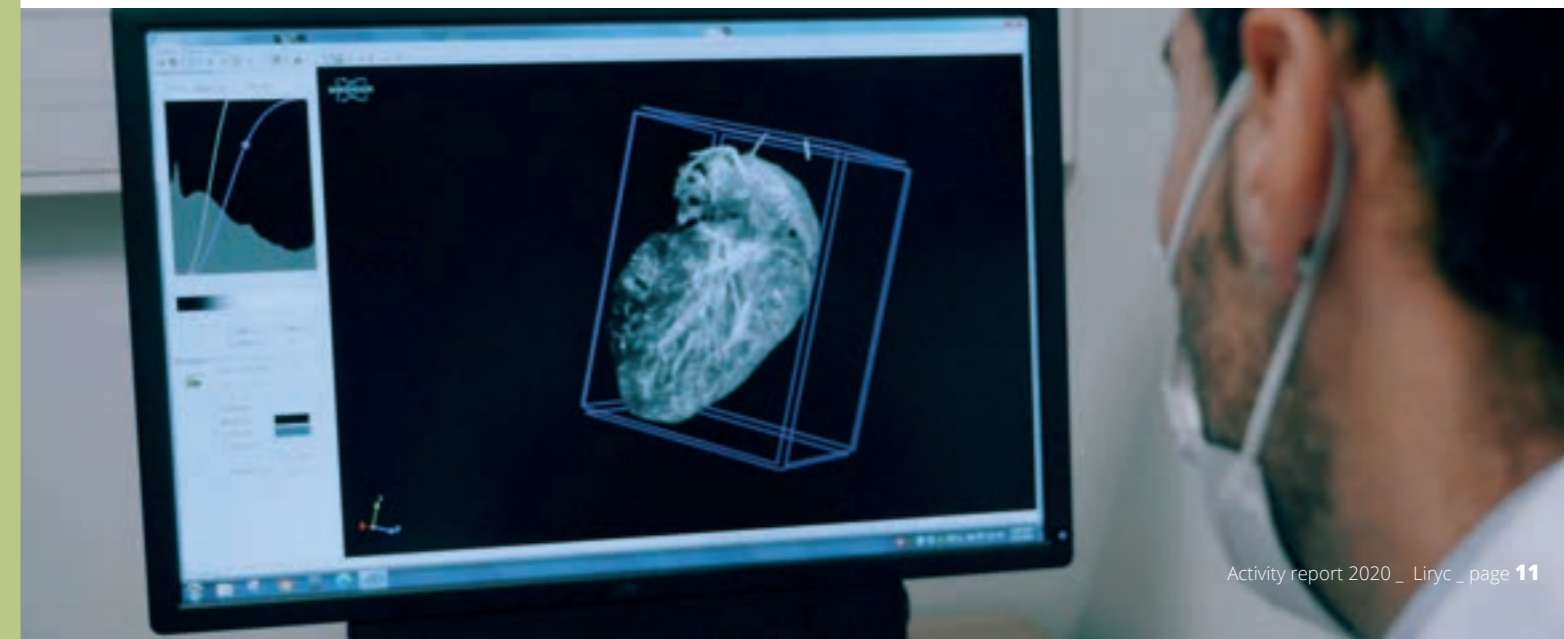
The COVID-CMR study, conducted by Pr Hubert Cochet, uses innovative imaging methods via MRI at a very high resolution, developed at IHU Liryc, to detect silent scars associated with COVID-19 on heart muscle. These scars have been observed in hospital admitted patients. The challenge lies in the fact that these myocardial lesions can cause heart rhythm disorders, by constituting anomalies in the structure of the heart. These same lesions can be at the origin of atrial fibrillations, tachycardias or ventricular fibrillations, possibly fatal. They may therefore have no consequence in the short term on the heart rhythm, but could generate rhythm disorders in time leading to a major risk in the upcoming decade. The research project began in the spring of 2020, with the first results expected in the fall of 2021.

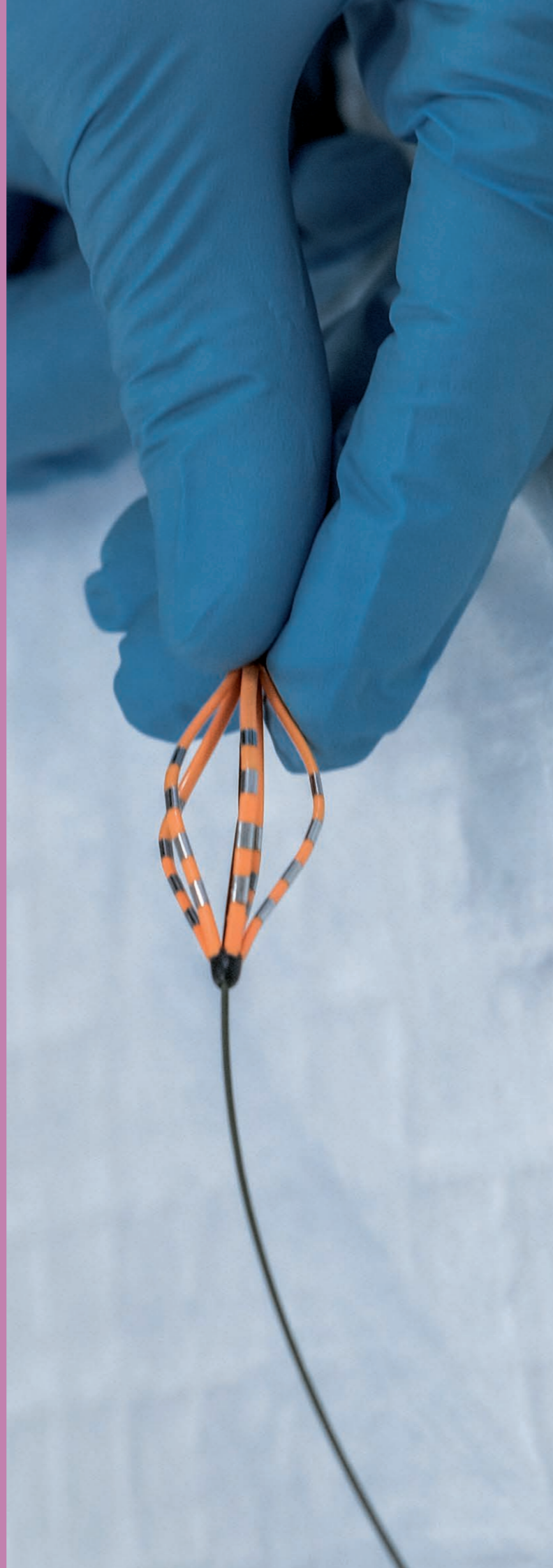
A second study, ASCCOVID19, measures the consequences of COVID-19 by focusing more particularly on the impact on the heart of high-level athletes. More than 800 athletes were recruited in the study and benefited from clinical investigations, ECG examinations, as well as cardiac MRIs in over 130 subjects. The results should be released in the summer of 2021 with health recommendations on resuming intense sports activity after the infection, applicable for professional and non professional athletes.

*Although cardiovascular diseases are one of the major comorbidities associated with the severe forms and deaths by COVID-19, it also appears urgent to better assess the level of risk of heart failure and of sudden cardiac death by detecting silent scars on the heart muscle on the general population in the upcoming decade.*



– **Prof Hubert Cochet**,  
health technologies team of Liryc  
and radiologist at the Bordeaux University  
Hospital





## HEADLINES IN 2020

- **Launching of the cardiac bioengineering platform project**

Liryc obtained a grant of €827,000 from the Nouvelle Aquitaine Regional Council and a financing from the National Research Agency to launch the platform and acquire the necessary equipment. The bioengineering platform will allow for the in-situ development of prototypes, medical devices or of innovative digital tools, while still developing the attractiveness of the institute.

- **Shareholding in Liryc spin offs**

In 2020, Liryc became a shareholder in two of its spin offs: Certis Thérapeutics, following its creation and inHEART, upstream of its capital raising of 3.7 million euros. This acquisition of a holding allows the institute to accompany its spin-offs for the development of innovative technologies.

- **Continued development of the new atrial fibrillation treatment by vein of Marshall ethanol infusion**

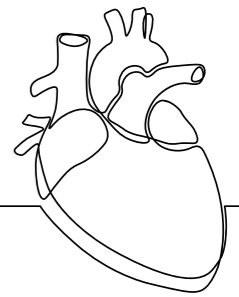
The clinical research project, led by Dr Nicolas Derval, won a grant of the Ministry of Health *PHRC*. In the framework of this project, Liryc continued its collaboration despite the health crisis with the Canadian company Agile to develop catheters specific to the technique in the process of clinical validation.

- **Development of innovations**

The teams developed a simplified portable ECG measuring tool at a low cost intended to facilitate the monitoring of the patients' heart function.

Other innovation projects to develop transverse research tools: new methods for processing the signal and invasive mapping via catheter, and non-invasive (ECGi) and new software.

The institute has also worked with Farapulse, a pioneer in pulse field ablation therapy to revolutionize atrial fibrillation treatment.



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**30**  
**COLLABORATION**  
**CONTRACTS**

concluded since 2012  
with the industry

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## QUICK ECG: EASY REMOTE MONITORING OF THE HEART FUNCTION

**The COVID-19 health crisis revealed a growing need for simplified tools to facilitate the monitoring of the heart function of patients treated. This is why the innovation team, led by Prof Rémi Dubois and Dr Sylvain Ploux developed a portable modular ECG measuring device, "Quick-eCG", to monitor patients remotely from their home.**

In 2020, Liryx research engineers developed the prototype of a portable modular ECG measuring unit, no bigger than a cereal bar. It records between 1 and 6 derivations transmitted to a smartphone via Bluetooth. The unit's software was developed by Liryx and the smartphone application by the Hilo agency in Bordeaux. The data collected is then sent directly to a server to be read and securely stored.

This new portable electrocardiography system is highly mobile and easy to use. It can be given to patients who can monitor their heart function from home and transmit it on a daily basis to the medical team. The healthcare teams would then be able to anticipate a degradation in the health of patients. It was also designed to be inexpensive making it possible to consider large-scale deployment across the territory and easily accessible as well in developing countries.

The first application is scheduled for mid-2021 to monitor telecardiology patients with the Careline company, a partner of the IHU. Quick-eCG as such reinforces the telecardiology activity of the Bordeaux University Hospital, enabling a better monitoring of patients suffering from heart rhythm disorders.

This project is supported financially by the Nouvelle-Aquitaine Region.

*The collaboration with Liryx and the use of the remote monitoring data for research was at the very origin of the creation of Careline Solutions. Our objective was to collect data that could benefit patients directly thanks to artificial intelligence.*



**Sylvain Ploux**, cardiologist at the Bordeaux University Hospital Center & Liryx, co-founder of Careline Solutions



## REMOTE MONITORING & ARTIFICIAL INTELLIGENCE: FOCUS ON THE LIRYC/CARELINE SOLUTIONS PARTNERSHIP

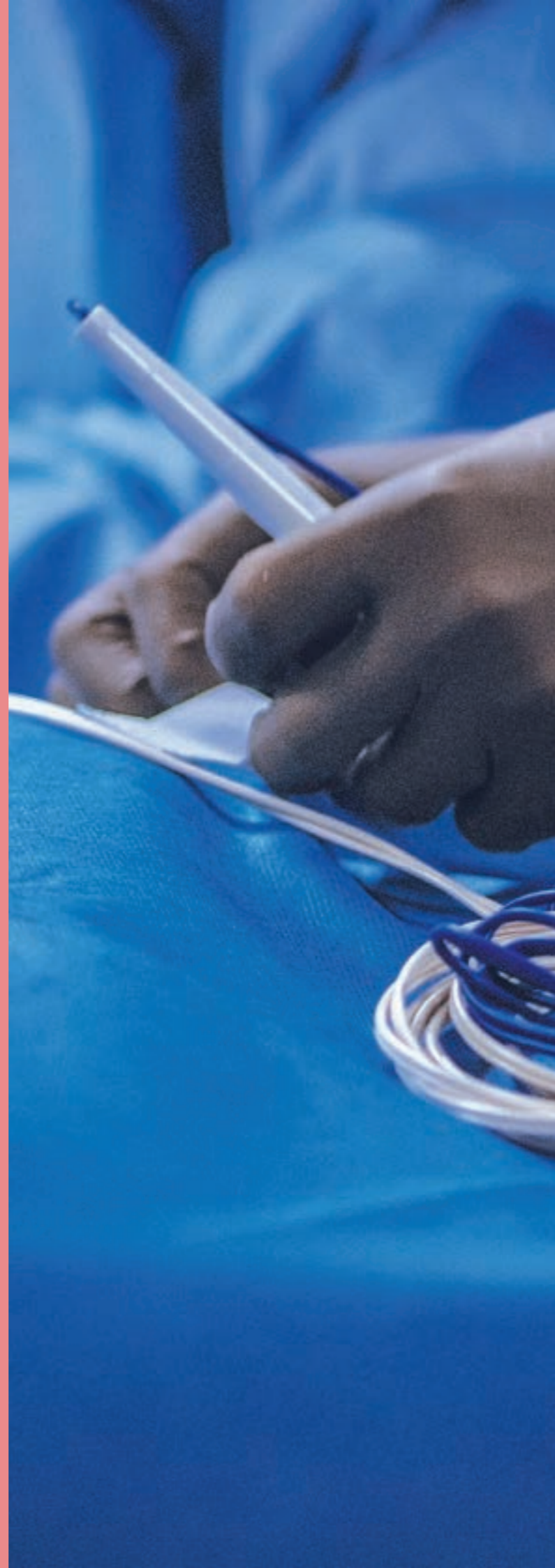
**In July 2019, Liryx engaged a partnership with the Careline Solutions company to improve remote monitoring of patients suffering from chronic heart pathologies. With nearly 1,200 patients monitored in France by the company, Careline makes valuable data available to research thanks to its unique innovative technology.**

Designed as a multi-mode remote monitoring tool, the Careline Solutions platform groups together into a single point all of the biometric and biological data as well as that of pacemakers and implantable defibrillators, for a more complete daily follow-up. The partnership with Liryx seek the objective of optimizing care, prospectively making use of the remote monitoring data in an ambitious artificial intelligence research program.

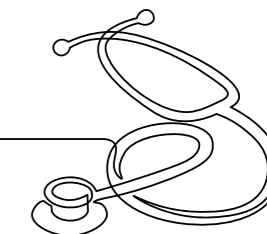
Today, the yield from the reading of teletransmitted data from implantable cardiac devices is low as it is too voluminous. The aim of the research teams is to develop an artificial intelligence algorithm that can read and sort this data autonomously, in order to facilitate the work of the remote monitoring teams. The preliminary results are already very promising. Introducing artificial intelligence into the platform also means developing a complex program that aims to predict the phenomena of ventricular tachycardia, ventricular fibrillation or severe heart decompensations leading to cardiac arrest.

The teams are also working on extending the platform to other pathologies such as the remote monitoring of congenital heart defects, diabetes or chronic obstructive pulmonary disease (COPD). These pathologies represent a genuine financial challenge in terms of care. The current follow-up of chronic heart pathologies alone already makes it possible to prevent most hospitalizations. This is a major concern when there are 150,000 people hospitalized every year in France for heart failure. At the horizon of 2021, Liryx and Careline will renew their partnership agreement in order to continue the ambitious research program. It will also entail responding to the challenge of raising funds to carry on optimizing the platform.





## HEADLINES IN 2020



- **Continuity of care during the COVID-19 crisis**

On top of the remote consultations organized with the mobilization of the teams, the telecardiology department has set up remote monitoring of 342 heart failure patients. A total of more than 6,400 patients are remotely monitored ensuring continuity of care.

- **Clinical studies to improve the care of patients**

The clinical teams pursued their work to improve the care of patients with rhythm disorders, in particular in the framework of atrial fibrillation.

Vein of Marshall ethanol infusion has demonstrated very good results in persistent atrial fibrillations.

The teams also focused on studying new energies for catheter ablation procedures. The teams contributed to the design of cryotherapy catheters, as well as the preclinical and clinical validation thereof. They also extensively studied pulsed field ablation demonstrating the effectiveness of the ablation technology with faster and more effective interventions than with radiofrequency, today's reference treatment, and with no damage for the non-cardiac collateral tissue.

- **Construction of a Data Hub for the management of clinical cardiology data in liaison with the Bordeaux University Hospital Center**

The "Dare" project, run by Dr Josselin Duchateau aims to build an optimum infrastructure for managing clinical data in order to optimize the care of patients and facilitate research by harmonizing the data and allowing researchers access to this pseudoanonymized data.

- **1<sup>st</sup> place for electrophysiology care teams**

For the 2<sup>nd</sup> year in a row, the telecardiology and heart stimulation department at the Bordeaux University Hospital Center ranked n°1 in the "Le Point" journal's survey. This ranking takes into account the quality of patients' management with heart rhythm disorders among 348 hospitals in France.

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**6,492**  
patients remotely  
monitored

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## FOCUS ON THE RARE DISEASE REFERENCE CENTER «COMPLEX CARDIAC CONGENITAL MALFORMATIONS» M3C

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**Labeled in 2017 as a Reference Center for Rare Diseases in the M3C network (Complex Cardiac Congenital Malformations, of the CARDIOGEN subsidiary\*), the congenital heart defects unit of the Bordeaux University Hospital Center is a major player in the diagnosis and the management of complex cardiac congenital malformations.**

In terms of care, the unit located at the Haut Lévêque heart hospital benefits from a high-technicity plateau where cardiologist, surgeons and resuscitators work together on the most complex congenital heart defects. As a referral center, its extends well beyond Nouvelle-Aquitaine.

The unit succeeded in pursuing its dynamism within the M3C network on an inter-regional and national scale despite the COVID-19 crisis by initiating many virtual meetings, such as the consultative meetings in genetics, an annual conference in an adapted version and the fetal cardiology meetings.

From a research standpoint, the implantation at IHU Liryc provides with a scientific environment boosting technical innovations, and supporting for university courses. The Bordeaux M3C center is a nationally and internationally recognized training center.

Immersed within the department, the association Les Liens du Cœur is an ongoing partner working hand in hand with the M3C network. Parents, volunteers and care givers work together to support patients during hospital stays. The association also conducts actions based on patients' needs that extend well beyond the stay: therapeutic education, resuming physical activities, social support, any action that can help the patient and their family for everyday life!

\* The national health subsidiary Cardiogen groups together various actors in caring for hereditary heart diseases.



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*At the frontier between care and research, the reference center allows patients and families to benefit every day from a coordinated and adapted care for complex cardiac congenital malformations.*

**Prof Jean-Benoit THAMBO**, head of the congenital cardiovascular diseases department, Bordeaux University Hospital Center & Liryc

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## TELEMEDECINE ALLOWING CARE CONTINUITY IN 2020

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**At the heart of the COVID-19 health crisis, the medical teams of Liryc and of the Bordeaux University Hospital Center, joined forces to accelerate the deployment of telemedicine, and as such ensure continuity in the management of patients with heart rhythm disorders.**

With regards to telemedicine, a first organizational line of innovation in 2020 was to generalize remote consultation during the lockdown and thereafter. In a context of COVID-19 with a substantial generalized decrease in hospitalizations for infarction reported in several countries, remote consultation encourages patients with rhythm disorders to consult.

2020 also saw a higher number of patients remotely monitored, with the inclusion of 342 additional patients for heart failure, via the Careline remote monitoring platform. At the end of 2020, there were 6,492 patients who were remotely monitored, again confirming the University Hospital Center's place as a leader in terms of activity volume in cardiology remote monitoring. Health care teams could remotely interpret the data required for medical follow-up of patients and, where applicable, make decisions concerning their care. Remote monitoring constitutes an important vector for improving the quality and the effectiveness of care. It also aims to improve the quality of life, by preventing complications at home.

The teams are now working on expanding the scope of remotely monitoring patients, by setting up a common platform for different specialties to extend the number of parameters monitored, starting with pneumology. The objective will be to allow for regular and complete monitoring of patients, based on fluid exchanges between the different health professionals. The platform also opens up enormous perspectives in terms of research by giving access to more parameters in order to better understand heart rhythm diseases.

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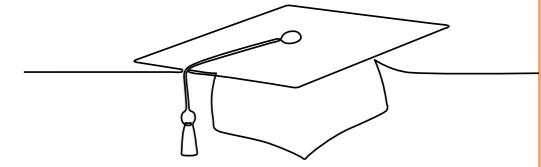
*The reorganization of care in the context of the health crisis has globally been welcomed very well by the patients, who reported feeling better accompanied. Our challenge today is to go further in telemedicine for a better care for patients.*

**Prof Pierre Bordachar**, in charge of the heart stimulation and defibrillation department, Bordeaux University Hospital Center & Liryc





## HEADLINES IN 2020



- **Modification in the training calendar linked with COVID-19**

In the context of the COVID-19 health crisis, the pedagogical team had to postpone the three editions of summer school and 75% of the training sessions with the industry, difficult to adapt to a digital format.

Liryc continued its training mission with health professionals and students by proposing new virtual formats: conferences with international experts, daily courses for externs in medicine and international digital conventions.

- **Development of an e-learning platform**

The teams worked on creating a Liryc e-learning platform, that will be launched the spring of 2021. It will offer varied training content in the field of electrophysiology, and more specifically ablation and cardiac stimulation, intended for students, ongoing-training for health professionals but also international cardiologists.

- **A second edition of the University Diploma in remotely monitoring implantable cardiac devices**

After the success of its first edition, the program was adapted to be given remotely and enriched by a selection of content available on an e-learning training platform, allowing 20 students to participate in it.

- **A Master to Doctorate program approved by the University of Bordeaux**

Liryc is part of the global "Master to Doctorate" program with the creation of an entirely new international course "Master II Electromechanical heart disease". It will propose an innovative training offer in English for medical students, doctors, biologists, mathematicians, and physicians in the fall of 2021.

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**240**  
health professionals  
trained

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## 2020, IN THE ERA OF E-TRAINING

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**In 2020, Liryc accelerated the digitalization of its training programs in order to respond to its mission of training health professionals and students, in light of the travel and meeting restrictions. Remote training, webinars, content hybridization, e-learning platform, the pedagogical team set up flexible and more accessible courses.**

Right from the start of the COVID-19 crisis and in accordance with the guidelines of the University of Bordeaux, Liryc's pedagogical team had to postpone its 3 summer schools scheduled for the summer of 2020, as well as 75% of its ongoing training programs in collaboration with the industry. Those programs were hardly adaptable to a digital format. Nevertheless, in parallel of these modifications in the training calendar, the teams set up new formats by making use of digital tools to guarantee mastery of innovative care techniques.

This is the example of the "Alliance program" virtual conference, organized in partnership with the Boston Scientific company that brought together more than 360 international professionals for live interventions in ablation rooms of the Bordeaux University Hospital Center to present the new therapeutic approaches in atrial and ventricular fibrillations. Other expert conferences made it possible to maintain the exchanges between researchers, doctors, engineers and students to address innovations in electrophysiology.

The teams were mobilized in 2020 to develop an online e-learning platform. The objective of this platform, launched in the spring of 2021, is to offer various training content in the field of electrophysiology and more specifically ablation and stimulation. The support materials are accessible via different profiles in order to offer a program that is personalized for health professionals and for students, whether it be ongoing training or university training. The platform will also host all the training support materials developed by the institute.



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*The Liryc teams knew how to transmit their knowledge in a dynamic and convivial way and as such give a social dimension to the training that took place remotely this year. More than just a theoretical contribution, this telecardiological toolbox allowed me to make progress in my daily practice as well as to consolidate our organization by remaining faithful to the practice of our Center.*



**Claire Stamminger,**  
University Diploma student in 2020

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## FOCUS ON THE UNIVERSITY DIPLOMA IN REMOTELY MONITORING IMPLANTABLE CARDIAC DEVICES

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**After a first edition that validated the training of 16 participants, Liryc welcomed the second promotion for its university diploma in remotely monitoring implantable cardiac devices in the fall of 2020. It offers a training for the professionals who want to improve theoretical and practical bases in remote monitoring.**

On October 5, 2020, the second edition of the **university diploma** in remotely monitoring implantable cardiac devices began for the 20 paramedical health or clinical research professionals, involved in remotely monitoring these devices.

The training revolved around two stages, combining the teaching of both the theoretical and practical bases:

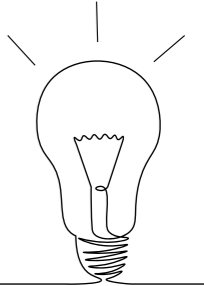
- A first part revisits the basics in rhythmology and the operation of implantable devices (Holter implantable, cardiac pacemaker, cardiac defibrillator and resynchronization)
- A second part is dedicated to the practical activity of remote monitoring. The practical section includes the teaching of the operating specificities of the devices of the different brands, in liaison with the medical device industry manufacturers. This collaboration allows the institute to have a more concrete approach, with more cross-line skills blocks.

In the framework of the health crisis, the sessions were able to be maintained as distance learning sessions.

The sessions were given by the cardiac stimulation teams and the telecardiology team of Pr Pierre Bordachar, who to date has the most activity in cardiology remote monitoring in France.



## HEADLINES IN 2020



### • **Recruiting procedure for the general director**

The management board of the IHU launched in 2020 the international recruitment procedure for the renewal of the general director after 2 successive 4-year terms fulfilled by Pr Michel Haïssaguerre. The new director is scheduled to officially begin on February 1, 2021.

### • **Moving towards self-financing**

In the framework of its 2020-2025 strategic plan, Liryc has changed its economic model towards more of its own financing in order to offset the scheduled reduction in the annual support from the French National Research Agency. In this context Liryc initiated in 2020 a major fundraising campaign to collect private funds, with a dedicated team and the recruiting of a fundraising director and a second collaborator in charge of international prospection.

### • **Continuity of research activities during the COVID-19 crisis**

Right from the start of the health crisis, the institute implemented the means recommended to protect its members and to allow for the continuation of its activity with 72% of the members who were able to perform their activity by teleworking. New work tools and methods were developed in order to maintain the institute's activity.

Liryc also made available all the pertinent equipment for patients' management suffering from COVID-19 (gloves, blouses, hydro-alcoholic gels, biomedical equipment, respirators, etc.) to the health care team at the Bordeaux University Hospital Center and mobilized its clinical and research teams.

## AN AMBASSADOR FOR THE LIRYC INSTITUTE

Jean Galfione, the 1996 French Olympic champion and current cross Atlantic competitive sailor, has committed alongside Liryc to fight heart rhythm diseases and further the research.

The institute's first ambassador, the French athlete who today is a skipper on the Serenis Consulting sailboat, is now on board with Liryc's researchers and doctors and will engage his visibility to support the cause, in the framework of his sailing projects.

## OVERLAPPING PERSPECTIVES ON 2020

*By joining the Liryc management board, my objective is to participate in making things move forward. I know what a patient lives through, I have a pragmatic and clear vision. My idea is to highlight the benefit of Liryc's research for patients.*



– **Christophe Biais**,  
former Liryc patient, member of the administrative board of Liryc

*In 2020, Liryc continued its excellent scientific work, despite the challenges caused by the restrictions of the COVID-19 pandemic. The International Scientific Board has identified many notable scientific advances during this year, in the clinical as well as experimental domain. These achievements concern all the research platforms. Indeed, it is important to note that these projects involve all the teams, which thus underlines a common philosophy at Liryc, a pillar in scientific quality. Liryc therefore is a unique opportunity for high-level scientific progress at the international level.*



– **Prof André Kléber**,  
member of the international scientific board, Harvard Medical School

*I was deeply seduced by the passion of the researchers, their sense of dedication constantly challenging themselves to revolutionize the treatment of heart rhythm diseases, that affect millions of people worldwide. In 2020, I joined the adventure of these people who are fighting to provide solutions. You can support the Liryc institute, just like me.*



– **Jean Galfione**,  
sponsor of Liryc

*In 2020, and despite the health crisis challenges, Liryc knew how to make use of its agility and capacity to adapt its research activities, initiate innovative projects and support the collective fight against the pandemic with the Heart and COVID-19 research projects, supported by the Nouvelle-Aquitaine Region. 2020, is also the launching of the institute's first fundraising campaign, which constitutes a major lever for development with the ambitious public-private economic model of the IHU.*



– **Françoise Jeanson**,  
delegate regional advisor to health and the silver economy, Nouvelle-Aquitaine Region member of the management board of Liryc

*Liryc in 2020 adapted to an unprecedented context forcing new work methods and collaborations in order to allow us as such to pursue our commitment against heart rhythm diseases.*



– **Prof Michel Haïssaguerre**,  
director of Liryc

# FINANCIAL REPORT

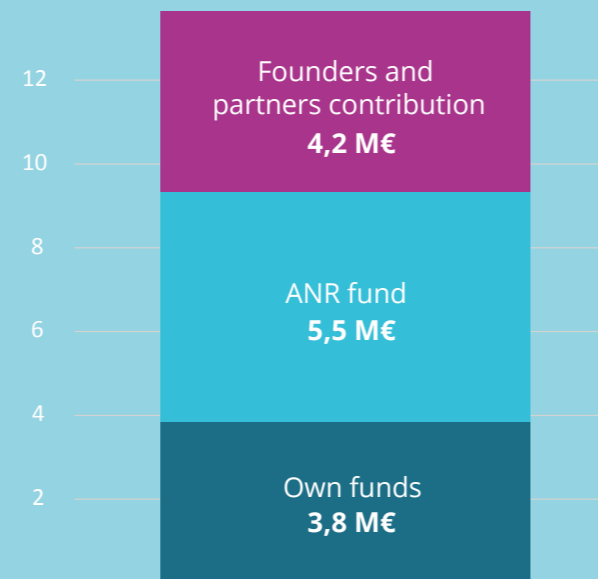
The financial report is presented for the global perimeter of the IHU.

It takes account of:

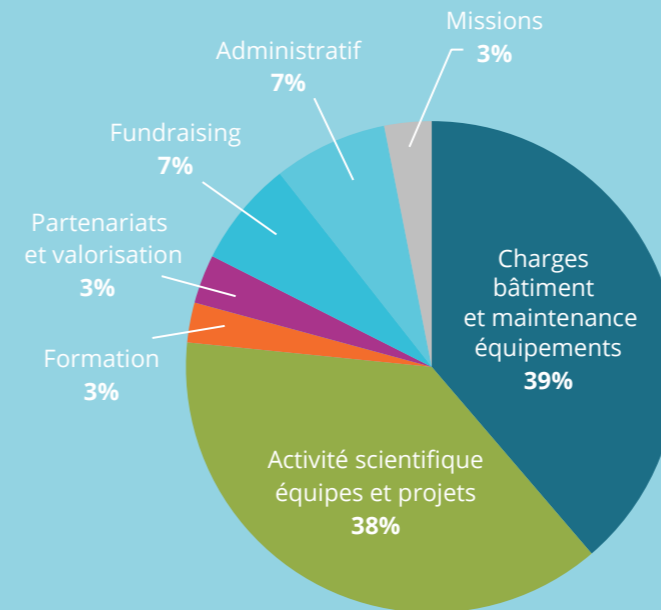
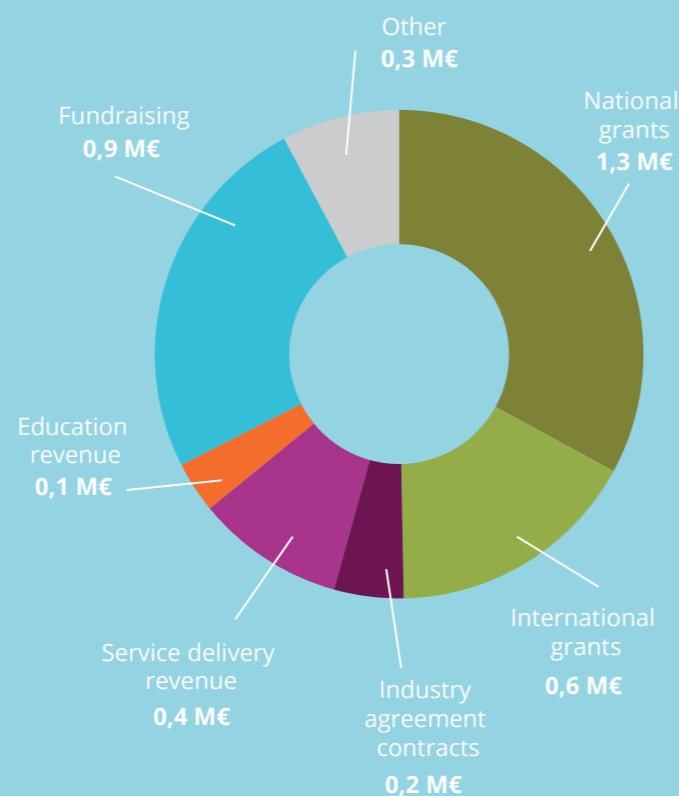
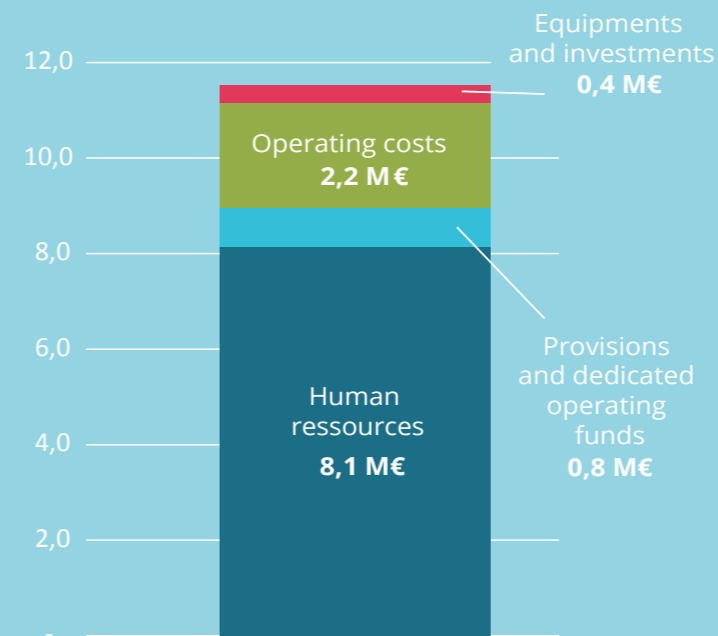
- Funds managed by the foundation hosted by the University of Bordeaux Foundation,
- Funds managed by the founding members on behalf of the IHU (both for the ANR agreement and for the other research conventions),
- The valuation of the contribution in terms of personnel of the founding members and partners of Liryc,
- Own sources of funding: training, provision of services, industry collaboration, national and international fundraising and grants.

The funds linked to the patients' management are managed directly by the Bordeaux University Hospital Center.

## RESOURCES IN 2020



## EXPENSES IN 2020



*The year 2020 was an exceptional year affected by the health crisis, not only at the level of resources, with a drop in revenue from services, training and collaborations, but also regarding expenses with the closure of the platforms for two months and the postponing of investments. This year nevertheless is closing with the launching of a major fundraising campaign opening to a favorable outlook for achieving the institute's ambitious scientific program.*

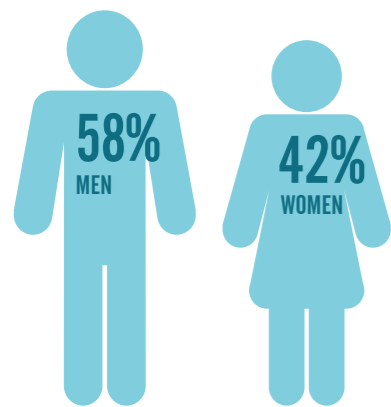


**Hervé Normand**, administrative and financial manager

# HUMAN RESOURCES

162

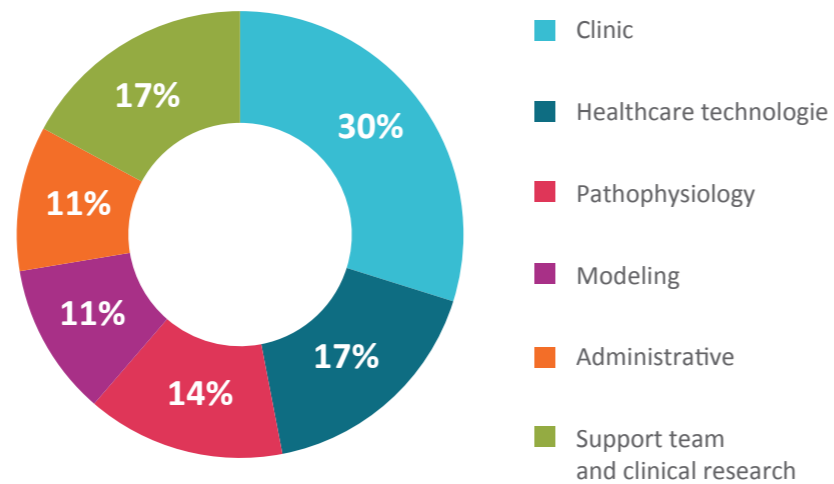
WOMEN AND MEN  
TOTAL WORKFORCE IN 2020



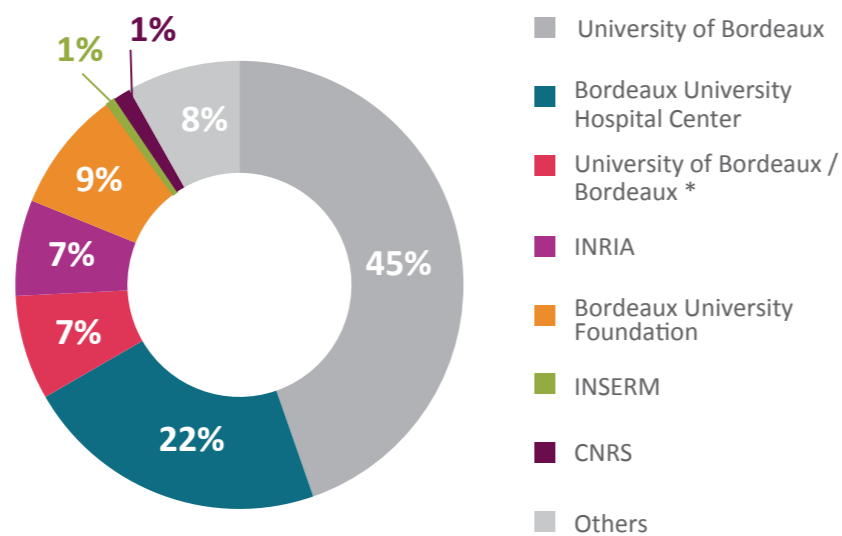
37 years

AVERAGE AGE

## 5 TEAMS DISTRIBUTION OF EMPLOYEES BY TEAMS



## DISTRIBUTION BY MAIN EMPLOYERS



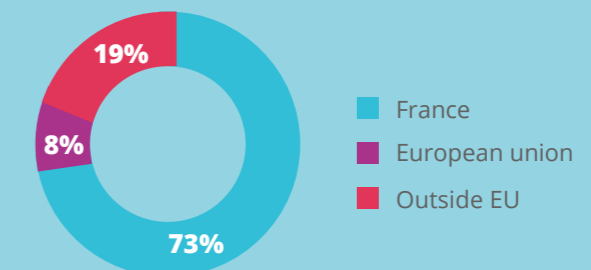
\* Personnel with a double affiliation

# 23 NATIONALITIES

- England
- Belgium
- Cambodia
- Canada
- China
- Denmark
- Spain
- United States
- France
- Greece
- Mauritius
- India
- Italy
- Japan
- Lebanon
- Morocco
- Mexico
- New Zealand
- Netherlands
- Switzerland
- Chad
- Tunisia
- Venezuela



## Distribution by origin







## HEADLINES IN 2020

- **The Light Up Your Heart campaign. Objective: 10 million euros in 5 years**

2020, the first year of the campaign, not only allowed us to develop the identity and the supports for the Light Up Your Heart campaign, but also to form the campaign committee. As a major lever in prospection, the committee gathers major donors who accepted to go beyond their donations and to mobilize their network and to build initiatives to expand Liryc's support community.

Composition of the committee:

- Michel Vounatsos, CEO Biogen
- Mark and Laura Bailey, donors
- Françoise Jeanson, regional advisor
- Bernard Magrez, donor
- Brigitte Speckmaier, senior director EMEA Boston Scientific

- **A major donation from Bordeaux businessman Bernard Magrez**

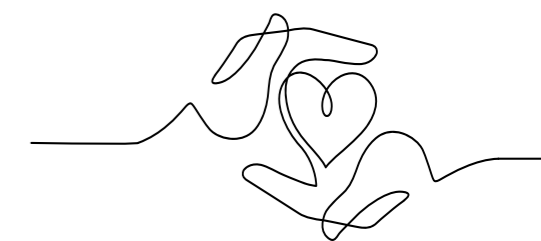
On September 24, Bernard Magrez, founder of the eponym group and owner of major international wineries, signed a donation convention in favor of Liryc. Bernard Magrez's major donation comes as support for the acquisition of the double photon-counting scanner, state-of-the-art equipment that opens up unprecedented perspectives for better identifying persons with a sudden cardiac death risk. Liryc is proud to weave privileged ties with first-rate companies in the region.

- **Setting up of a recognition program dedicated to the institute's donors**

The institute has set up a recognition program deployed progressively according to the amount of the donation. It aims not only to express Liryc's recognition for their support but also to offer them the opportunity to get involved even more with us. Visibility on our communication supports, invitations to the institute's events, and conferences at the headquarters of the company are all examples of our way of saying thank you.

In this context three circles of donors have been set up:

- **The Willem Einthoven circle for donations of over 500,000 euros.** Willem Einthoven (1860 – 1927 – Dutch), doctor, physiologist and physician, is at the origin of the invention of electrocardiography to record the electrical currents of the heart's contractions.



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## €997,428

were raised from  
private funds in 2020

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### They support us:

- ABBOTT
  - ANCRE
  - MARK & LAURA BAILEY
  - BIOSENSE WEBSTER
  - BOSTON SCIENTIFIC
  - BERNARD MAGREZ
  - MEDTRONIC
  - JACQUES RIOU
  - RUBIS
  - TECMATEL
-

## HEADLINES IN 2020

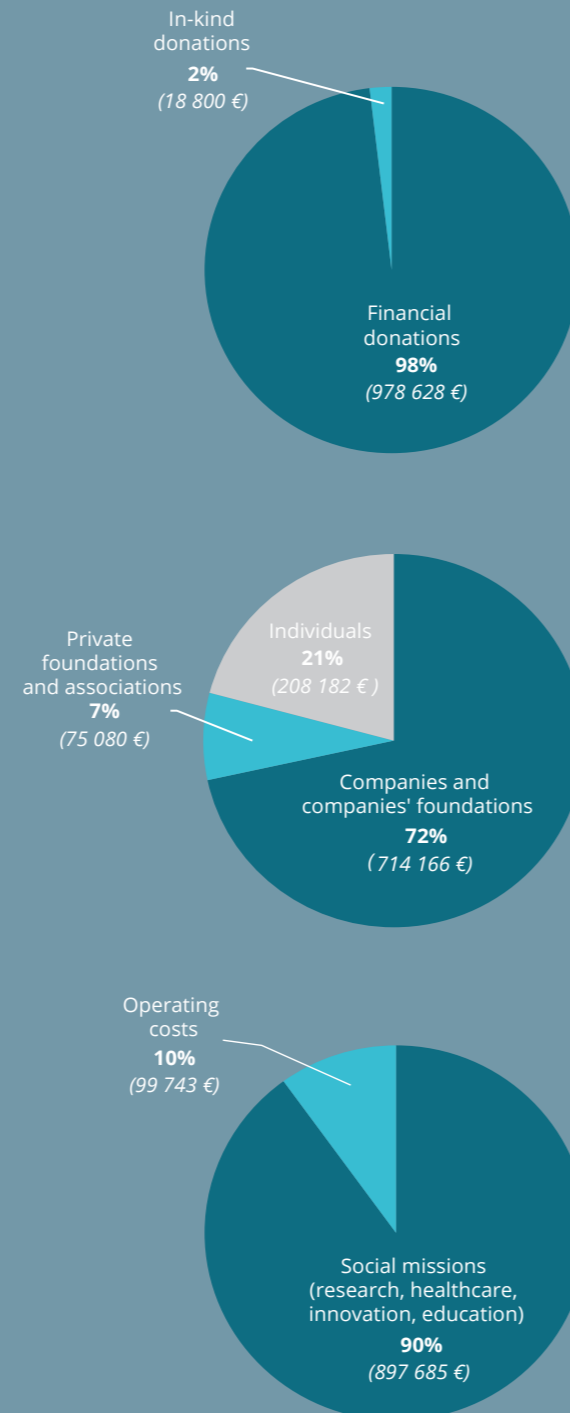
- *The Jan Evangelista Purkinje circle for donations between 50,000 and 499,000 euros.* Jan Evangelista Purkinje (1787 – 1869 – Czech), anatomist and neurophysiologist, revealed a tissue that ensures the fast propagation of the electrical influx within the heart's ventricles, allowing them to have a synchronous contraction: the Purkinje fibers.
- *The Christiaan Barnard circle for donations less than 50,000 euros.* Christiaan Barnard (1922 – 2001 – South African) is a South African cardiac surgeon who became famous for having performed in 1967 the first successful heart transplant for a patient with heart failure.

### • Participation in the international Giving Tuesday initiative

Liryc took advantage of the world day for generosity, Giving Tuesday, to increase public awareness of heart rhythm diseases through a communication campaign on the social networks. An opportunity also to highlight certain innovative projects and to acknowledge the commitment of its members, partners, donors and patients.



## FUNDRAISING REPORT



## A MESSAGE FROM A DONOR

Mark Malekoff was referred to Liryc by his Canadian physician after a cardiac arrest. Now a donor to the institute, he agreed to share his positive story to help educate others about heart rhythm disorders and to explain how he decided to support Liryc in turn.

### If you had to summarize your medical background, what would you say?

After being a high level athlete my whole life and very active, I had a tremendous amount of disbelief that I suffered a cardiac arrest at the age of 33. Further, with my Cardiac MRI being misdiagnosed after the cardiac arrest, there was a lot of unanswered questions and uncertainty. I was referred to Dr Hocini at Liryc and was able to receive a definitive diagnosis and a successful ablation procedure. All my questions were answered. I am now back to a moderately active lifestyle!

### What first encouraged you to financially support Liryc?

I was honestly so impressed with the care and attention I received from every single person at Liryc. Dr Hocini, all of the other doctors, nurses, techs and everyone else are very passionate about providing outstanding care and attention. I think it is very inspiring that Liryc not only treats heart rhythm disorders, but also works to prevent it. Preventing heart rhythm disease will make such an impact and will help so many people. I am so glad that I chose to go to Liryc for my procedure, and I feel honored to help them in anyway I can.

### What would you like to say to potential future donors of Liryc?

It is a great investment in the health of so many people on a global scale. If you ever visit Liryc you will see that the funds definitely go towards the right areas and they are without a doubt making a huge difference.

### Do you have a message for other patients?

I have dealt with many obstacles working to find a diagnosis and get treatment. But I am one of the lucky ones to have survived my cardiac arrest. The majority of people don't. I am so happy to share my positive story and help educate others about heart rhythm disorders. To conclude, one thing I learned in my health journey is that it can be quite a journey, filled with highs and lows, and it's very helpful to allow yourself to feel both grateful (for me surviving) and frustrated (for me having to deal with the related health challenges) at the same time.



**Mark Malekoff**, former Liryc patient and donor to the institute



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*The grant from the Lefoulon Delalande Foundation has allowed us to implement our research project, to better understand the electrical mechanisms in the presence of scars on the heart muscle. We can then optimize the artificial intelligence algorithms to guide ablation procedures and improve the management of patients with heart rhythm disorders.*

**Jairo Rodriguez Padilla**,  
post-doctoral researcher,  
modeling team, Liryc



They won financing for their research project in 2020:

- **Pierre Jaïs** for his BEAT AF project from the European Commission (Horizon 2020), and for the launching of the bioengineering platform from the Nouvelle-Aquitaine Region
- **Michel Haïssaguerre** for his research project on ultrasound from the Nouvelle-Aquitaine Region
- **Mark Potse** for his Microcard project from the European Union (EuroHPC)
- **Maxime Sermesant** for his SimCardiotest projects from the European Commission (Horizon 2020), then EIT Health from the European Union
- **Fabien Brette** for his ELECTRO project from the French National Research Agency (ANR PRC)
- **Nicolas Derval** for his Marshall-PLAN study from the French Ministry of Health and Solidarity (PHRC)
- **Marine Martinez** from the Lefoulon Delalande Foundation (grant)
- **Jairo Rodriguez Padilla** from the Lefoulon Delalande Foundation (grant)
- **Jean-Benoit Thambo** from the Fédération Française de Cardiologie (French Federation of Cardiology) (research endowment)
- **Zakaria Jallal** from the Fédération Française de Cardiologie (French Federation of Cardiology) (start-up assistance)
- **Hubert Cochet** for his COVID-HEART-MR project from the University of Bordeaux

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Marine Martinez, Maxime Yon, Angel Moreno, Girish Ramlugum, Jerome Naulin, Zakaria Jalal and Guido Caluori were the winners of the IHU 2020 internal calling.

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- **Launching of 3 major European research projects**

Launching of three scientific projects retained by the European Commission in the framework of its Horizon 2020 program: BEAT AF, to revolutionize the management for atrial fibrillation, MICROCARD, to go further in cardiac modeling and SIMCARDIOTEST, to develop an in-silico test platform.

- **Launching of the international master diploma**

Opening of the International Master 2 diploma "Cardiac EP: Electromechanical Heart Diseases" in the fall of 2021 to form the future generation of cardiologists, researchers and engineers in electrophysiology.

- **Renewal of the governance**

Following an international recruitment procedure, Prof Pierre Jaïs was appointed general director of Liryc by the administrative board effective February 1, 2021. He succeeds Pr Michel Haïssaguerre who will continue to be involved in the scientific life of Liryc as an honorary president.

The international scientific board will be renewed and will welcome two new international experts, Profs Srijoy Mahapatra and Dobromir Dobrev.

- **Launching of the major fundraising campaign**

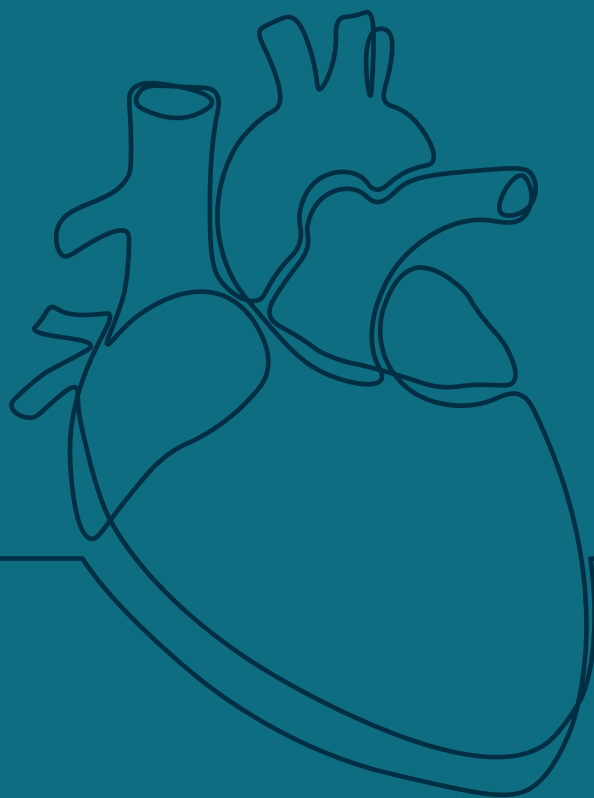
Various major internal and external events will present in 2021 the major "Light up your heart" campaign to mobilize and expand the support community of the Liryc institute.



*I am delighted to run an institute that is part of a local, national and international ecosystem of excellence, to take on major scientific challenges such as improving the care and prevention of heart rhythm diseases, thanks to decompartmentalized research and an ambitious training program to train future generations.*



**Prof Pierre Jaïs,**  
general director,  
Liryc.



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and Heart Modelling  
Institute

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