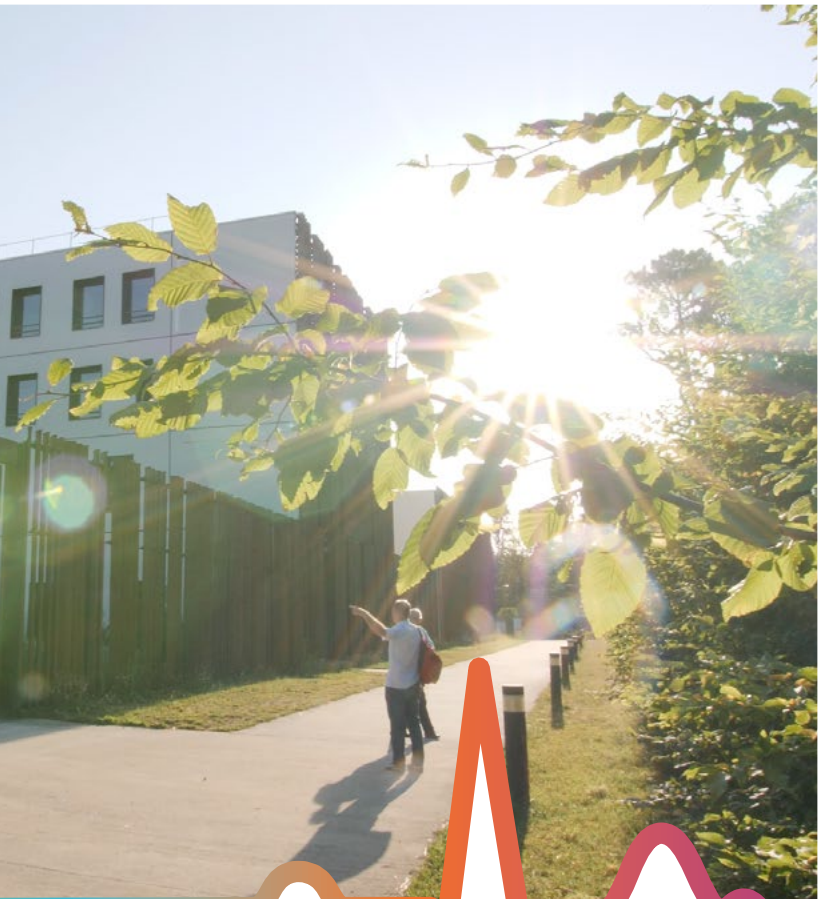




Electrophysiology
and heart modeling institute

“THE LIRYC BEAT”

NEWSLETTER N° 10 /// 1ST HALF 2020



EDITORIAL

LIRYC COMFORTED IN ITS AMBITIONS!



By **Michel Haïssaguerre**,
Director of LiryC

2020 marks both the end of the initial “Investments for the Future” programme, which led to the creation of LiryC in 2010, and the beginning of a new adventure.

It took the institute ten years to build its unique platforms and research infrastructure, bringing together world-class experts from different disciplines and academic institutions and industrial players, with a common objective: to improve the prevention and treatment to heart rhythm diseases.

Our scientific programme and business plan have been approved by the French National Research Agency and the Prime Minister, who granted us an additional 16 million euros of funding for the next five years.

LiryC’s roadmap to 2025, as detailed in this newsletter, is both exciting and ambitious. It aims at addressing the challenges associated with diagnosing and treating patients suffering from heart rhythm diseases or at risk of premature death. LiryC’s teams and partners, whose excellence, involvement, and dynamism have been recognized by an international jury, are ready to take up this challenge.

Thank you all and have a great 2020!

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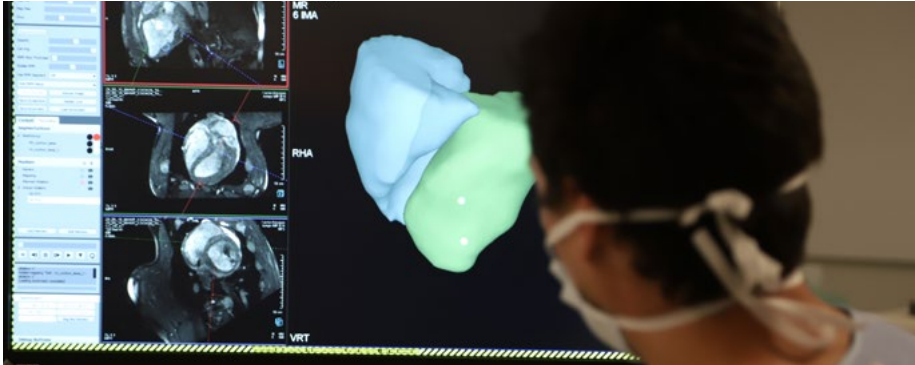
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BETTER UNDERSTAND IN ORDER TO CURE



Our translational research program has originated from today's unmet clinical needs and the newly emerged of new scientific hypotheses. A better understanding of the mechanisms underlying cardiac electrical disorders will enable the development of novel tools to improve diagnosis and optimize treatment.

About atrial arrhythmias

A major objective is to identify the molecular targets that play a key role in triggering and maintaining atrial fibrillation. High-resolution imaging and electrical mapping will further allow determining new markers of disease progression and setting up personalized prevention, through medication or targeted ablation. New ablative strategies are being developed in the clinic, raising hopes for a standardized and efficient ablation procedure in persistent atrial fibrillation.

About ventricular arrhythmias

The ambition is to develop novel risk stratification markers of sudden cardiac death and develop screening and prevention tools based on the individual mapping of ventricular abnormalities. This challenge requires a detailed

investigation of the diseased cardiac tissues. As current clinical imaging tools and genetic screening remain limited, it will be necessary to develop non-invasive electrical mapping approaches for the screening of patients at risk of sudden cardiac death.

About electromechanical malfunctions

The goal is to get a better understanding in the mechanisms underlying cardiac electromechanical dysfunction, in the context of various pathologies (myocardial infarction, cardiomyopathies, and congenital disorders). Work will also continue on optimizing Cardiac Resynchronization Therapy in heart failure, in order to harmonize electrical propagation and better coordinate the ventricular contraction, ultimately improving the mechanical function of the heart.

→ HIGHLIGHTS

Two women scientists, world-class leaders, appointed at the Scientific Advisory Board of Liryc.

From now on, Barbara Casadei and Katja Zeppenfeld will have to evaluate the scientific progress of the institute and provide advice on its annual action plan.

Barbara Casadei is the current President of the European Society of Cardiology; she is a British Heart Foundation Professor and Honorary Consultant in Cardiology at the John Radcliffe Hospital in Oxford.

Katja Zeppenfeld is a clinical electrophysiology professor and head of the clinical electrophysiology research centre in Leiden, The Netherlands. She also has several duties within the European Heart Rhythm association.



→ FOCUS ON

International scientific meeting at Liryc

Liryc welcomed the members of the Scientific Advisory Board during its **3rd Scientific Workshop**, on Monday

13th and Tuesday 14th January, for two days of fruitful discussions on sLiryc's multidisciplinary projects; with one goal: sharing and advancing science, improving the understanding of heart rhythm diseases and sudden cardiac death.





A NEW CARDIAC BIO-ENGINEERING PLATFORM

The institute will set up a cardiac bio-engineering platform to enable in house development of prototypes and digital tools, to increase its attractiveness and stimulating innovation.

Liryc already has a state-of-the-art experimental platform dedicated to fundamental research, and its clinical team leads a clinical department at the Bordeaux University Hospital. These facilities enable the preclinical and clinical validation of bio-medical innovations in collaboration with the industry.

The new bio-engineering platform, at the interface between research and patient care, will allow Liryc performing in house prototyping of medical devices and tools. Until now, this prototyping was performed by industrial partners or service providers, most often based abroad.

The platform will be built in the institute's spare 500m². It will consist of engineering laboratories essential for prototyping (moulding, welding, assembly, etc.) and a dedicated area for the implementation of innovative projects, both by Liryc's teams or in collaboration with external partners. It will also include a test bench simulator for new catheters.

This open platform will allow achieving several objectives, positioning the institute as a key player in innovation and industrial attractiveness. It should also increase the number of innovative projects for the development of more efficient and safer treatments.

→ MEDICAL INNOVATION

Atrial fibrillation: the "Marshall plan", winner of the 2019 Ministry of Health's National PHrc call for projects

This clinical research project, led by Dr. Nicolas Derval received a €612 206 funding of the Ministry.

It aims at testing a new ablation strategy for patients suffering from persistent fibrillation, in order to improve the success rate of this most complex arrhythmia, while reducing the risk of complications.



→ A LOOK BACK AT

Startups' views on innovation in cardiology



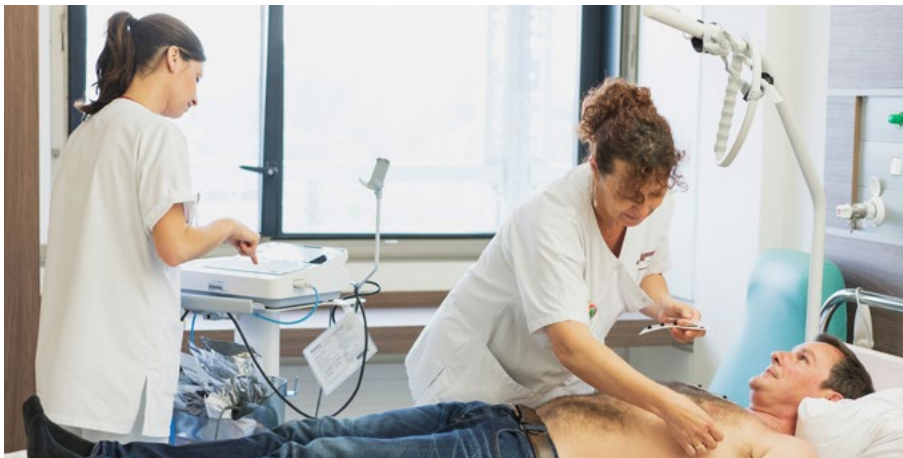
On December 12th, the institute held a conference on medical innovation in cardiology, in attendance of Michel Vounatsos, CEO of Biogen & new President of the Administrative Board of Liryc. He shared his viewpoint as an international healthcare industrialist with the start-ups' CEOs of FineHeart, OP2 drugs, InHeart and Certis Therapeutics.

“ The greatest asset is to listen to others, to have opposing views, to challenge each other. And that comes from being open-minded. ”

Michel Vounatsos ”



PREVENTING SUDDEN CARDIAC DEATH



Sudden cardiac death kills 1,000 people a day prematurely in Europe and represents 10 to 12% of global mortality.

It represents a scientific challenge and a major public health problem. Liryc's teams aim at providing solutions by identifying new markers to detect high-risk individuals in order to implement population-wide preventive measures.

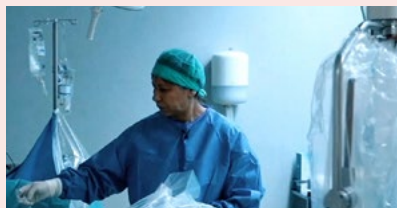
Lethal without a prompt intervention, sudden cardiac death is most often due to ventricular fibrillation leading to the loss of effective cardiac contractions. The identification of people at risk is a key objective to prevent these premature deaths through the implementation of medical or surgical therapies.

Today, several technical limitations prevent investigation into the causes of sudden cardiac death, sometimes remaining unexplained, particularly among young people under 40. These limitations are the inability of current clinical imaging techniques to identify tissue alterations; the lack of detailed cardiac electrical mapping in survivors; the occurrence of transient biological phenomena; or limitations in the interpretation of complex genetic variants.

Over the next years, Liryc's research programme will focus on the development of non-invasive techniques (without any use of intra-cardiac catheters), based on cardiac potential mapping and CT or MRI imaging to detect areas of electrical turbulence.

This will result in analyzing, from the body surface, the cardiac architecture and electrical field at very high resolution, to identify gradients (spatial differences) indicating electrical risk. This is similar to assessing plate tectonics and seismic risk from surface measurements.

It represents a major scientific and technological challenge.



Therapeutic innovation: cryoablation

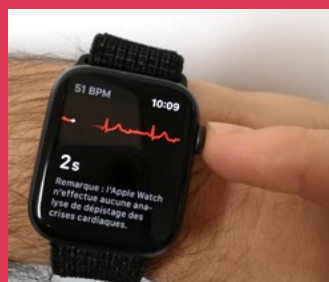
California-based Adagio Medicals, dedicated to the development of innovative cryotherapy ablation technologies (ultra cold -180° Celsius), is collaborating with Liryc to develop cryoablation catheters for the treatment of atrial fibrillation and ventricular tachycardia.

The Liryc teams contribute to the design of the catheters, as well as to their preclinical and clinical validation.

→ CARE & TECHNOLOGY

An independent study on smart watches

With the revolution of smart watches, able to measure an ECG on anyone's wrist, Prof. Pierre Bordachar's team is currently completing an independent study on 250 patients equipped with such watches, and also subjected to classic clinical examinations.



The main objective is to analyze the information obtained with smart watches and to identify the information that could be missing for a medical diagnosis.





→ RENDEZ-VOUS

3 SUMMER SCHOOLS FOR THE 2020

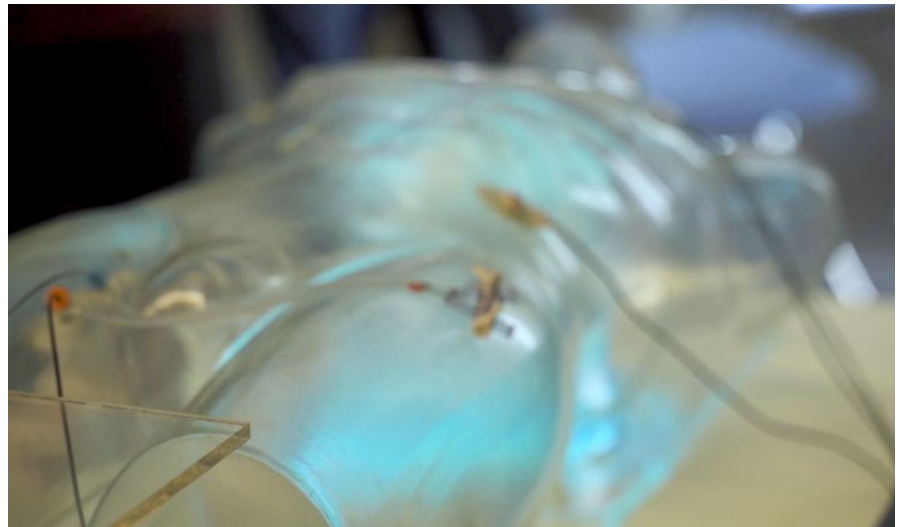
In addition to the cardiac electrophysiology summer school, Liryc will propose two new schools this summer.

- A **Summer School on Percutaneous Therapies for Congenital Heart Disease**, June 8th to 11th. It will bring together the professionals designing, manufacturing, implanting and evaluating the cardiac devices of tomorrow.
- A **“Gadgetron” Summer School**, June 17th to 19th, dedicated to the open source MRI image reconstruction software, improving image quality and thus clinical diagnosis.



15 TRAINING SESSIONS

a total of 133 professionals trained in innovative devices, in partnership with industrial players, in 2019.



A FUTURE CARDIAC SIMULATOR TRAINING CENTRE

Alongside with the construction of its University Research School programme, Liryc is building a training platform based on realistic cardiac simulators for intra-cardiac procedures. Designed both for beginners and experienced doctors, the platform will consist of several simulators for training in the latest catheter ablation procedures.

Developed by Liryc’s scientists and engineers, SIMRIC - the Mechanically Realistic Educational Simulator for Cardiac Interventions, allows to simulate an ablation procedure. It is composed of:

- An artificial transparent patient torso fitted with several sensors, in which a realistic 3D printed heart and a femoral vein for catheter introduction are incorporated;
- The technical and digital environment allowing for

the visualization of catheters introduced into the heart and simulation of realistic intra-cardiac electrical signals.

The future training platform will consist of 5 simulators, allowing to simultaneously train large groups of cardiologists.

These trainings will be intended both for doctors new to ablation, and for more experienced doctors, wishing to perfect specific procedures. It will also be available to manufacturers developing new catheters, to evaluate their prototypes and to train clinicians in their new technologies.

Simulator-based learning will also be integrated into the various training programs developed by Liryc.

In addition to its strong educational value, this future training platform is also in line with the recommendations of the French National Authority for Health to improve patient safety through the development of simulation tools in healthcare.

→ FOCUS ON

A GRADUATE SCHOOL FOR CARDIOLOGY

Liryc will be part of the next University Research School programme led by the University of Bordeaux in 2020, with the launch of a “Cardiac Electrophysiology Graduate School”.

It will be entirely dedicated to cardiology, with, at its center, an international Master’s degree currently being developed.



→ CONGRATULATIONS



Barbara Casadei presented this year's "Communications awards 2019". Nolwenn Tan and Thomas Hof were rewarded for their ability to popularize their cross-cutting research projects in 180 seconds.

This competition, rewarding young researchers, is organized thanks to a private donation by Mr. Jean-François Debrosis.



TOWARDS A NEW ECONOMIC MODEL



Liryc's roadmap for the next five years was approved by the international jury and the French government. As requested, they granted an additional funding of 16 million euros, with the objective of achieving financial sustainability by 2025.

This new roadmap reflects the institute's ambitions in terms of research, innovation, care and training up to 2025. It takes into account the financial contributions of the institute's founders and its partners over the next five years; whose contributions have already been a key success factor.

It includes major investment projects such as the cardiac bio-engineering and simulator training platform, the acquisition of a latest generation scanner, major research projects for

the prevention of sudden cardiac death, the treatment of atrial fibrillation or heart failure, and the ambitious "Graduate school" programme in cardiac electrophysiology.

To ensure continuity beyond the end of the public funding in 2025, the strategic plan anticipates the award of several French, European and international grants; the launch of a major fundraising campaign and the strengthening of collaboration programmes with industry.

This diversification of the institute's sources of income represents a major challenge in the coming years. In order to meet this objective, the contributions of Liryc's partners and philanthropists will be important, if not essential!

→ FOCUS ON

A 2nd edition of Liryc's Open Day in attendance of Jean Galfione

On September 28th Liryc welcomed nearly 300 people its second Open Day.

A day filled with workshops to demonstrate research and cardiac innovation, first aid initiation sessions for both children and adult, and sports activities.

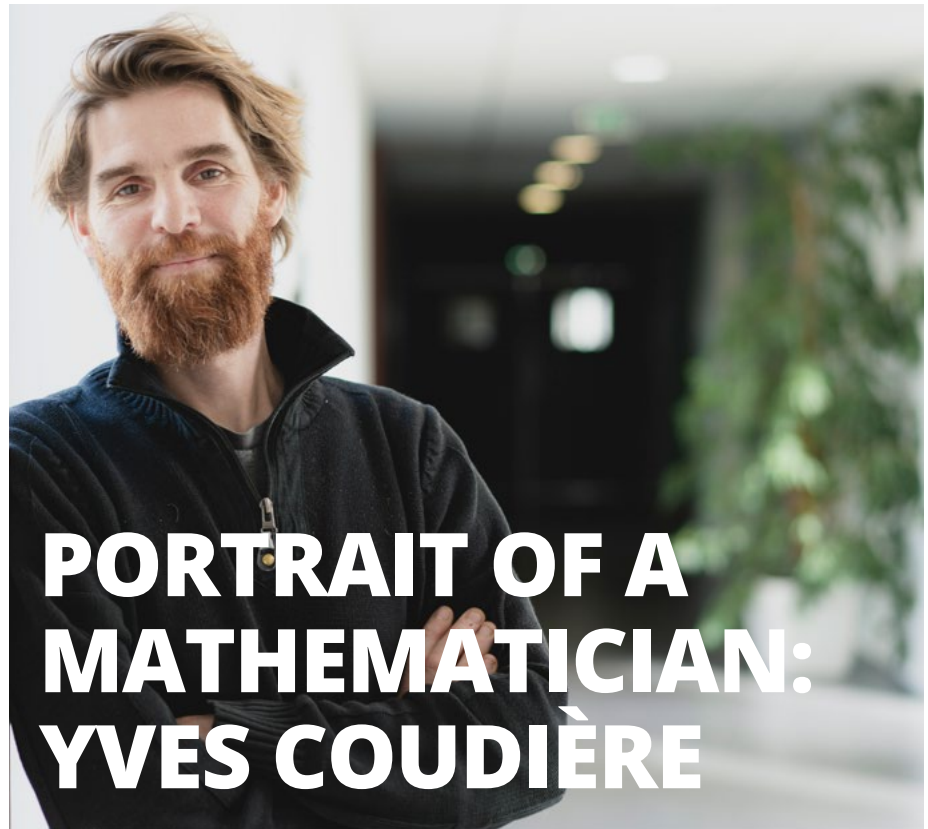
This successful event was concluded with a conference by Prof. Sacher and Prof. Bernus on sudden cardiac death in athletes, in the presence of Olympic champion Jean Galfione, who shared his experience on the preparation of a top athlete.





FÉLICITATIONS !

- **Jason Bayer** was awarded an European co-financing Eranet ERA CVD
- **Nejib Zemzemi** is investigator of an European Commission funded project.
- **Michel Haïssaguerre** and **Bruno Quesson** received a grant from the French National Reasearch Agency.
- **Rémi Dubois, Bruno Quesson** and **Richard Walton** obtained funding from the Nouvelle-Aquitaine Region Council.
- **Thomas Hof** received a scholarship from the Lefoulon Delalande foundation.
- **Fanny Vaillant** received funding from the Crédit Agricole d'Aquitaine foundation.
- **Mélèze Hocini** is the winner of the French Cardiology Federation's 2019 Research Endowment.
- **Bruno Quesson** received a 2019 thematic grant from the French Cardiology Federation.
- **Pierre Bour, Marion Constantin, Josselin Duchateau, Zakaria Jalal, Alice Récalde and Richard Walton** were awarded the 2019 Liryc internal translational research grants.



PORTRAIT OF A MATHEMATICIAN: YVES COUDIÈRE

Meeting with Yves Coudière, professor in the modeling team - at Liryc.

Yves, what is your job at Liryc?

I'm a mathematics professor, in charge of an Inria* team, the "Carmen" team, within the modeling group.

When did you join the institute?

I have been a member of the Institute since its inception in 2011.

What does it mean to be a mathematics teacher at Liryc?

My job at Liryc is first to lead the "Carmen" team, which works on various cardiac modeling projects.

Modeling is a mathematical approach used to create a virtual heart, based on

biological, medical and clinical data. It provides a better understanding of the mechanisms underlying rhythm disorders and also allows virtual testing of therapies, to guide physicians.

I also teach mathematics, and take part in various teaching and research tasks at the University of Bordeaux.

The special feature of my position is that I am working in several institutions: the University of Bordeaux and Inria, whose research teams are an integral part of Liryc.

What is your biggest pride?

My biggest pride is to have successfully lead a team of applied mathematicians out of their labs to join Liryc, and to exchange with other scientific communities. This is not very common in applied mathematics in France, because it is never easy to think outside the box.

On a completely different topic, when you were a kid, were you more into math, science or physics?

Even though I was better at physics, I've always preferred maths. And I've been programming on computers since I was 11!

* INRIA: National research institute for digital science and technology. Its mission is to boost research and technological innovation, in and through digital technology..



A LOOK BACK AT THE KEY EVENTS

→ SEPTEMBER 27TH 2019

Liryc scientists participated in the **European Night of Researchers** at Cap Sciences in Bordeaux, to meet the general public.



→ OCTOBER 14TH & 15TH 2019

The **Atrial Signals Conference**, organized by Liryc's teams, brought a hundred international experts, physicians and doctors together in Bordeaux.



→ DECEMBER 1ST 2019

The **Declics Operation**, took place at the Lycée Gustave Eiffel in Bordeaux, where Liryc scientists met high school students, to talk about research careers.

→ DECEMBER 2ND 2019

InHeart, the Liryc's spin-off, wins the **3rd place in the European Health Catapult competition** organised by the EIT network in the Digital Health category.

AGENDA



- **March 21st**
2nd Patient Day at the Centre of Reference for Hereditary Rare Diseases, Liryc
- **May 6th-9th**
International Congress of the Heart Rhythm Society, San Diego
- **June 4th**
Dîner de gala Rotary Club, au profit de Liryc
- **June 19th & 20th**
Rotary Club Gala Dinner, in favor of Liryc
- **June 8th-10th**
Percutaneous Therapies for Congenital Heart Disease Summer School, Liryc
- **June 17th-19th**
Gadgetron Summer School, Liryc
- **June 29th-July 3rd**
Cardiac Electrophysiology Summer School, Liryc



RESEARCH - INNOVATION - PATIENT CARE - EDUCATION

Donate to support Liryc
and help to prevent and cure heart rhythm diseases.

www.ihu-liryc.fr



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