PersonalizeAF Eight Newsletter

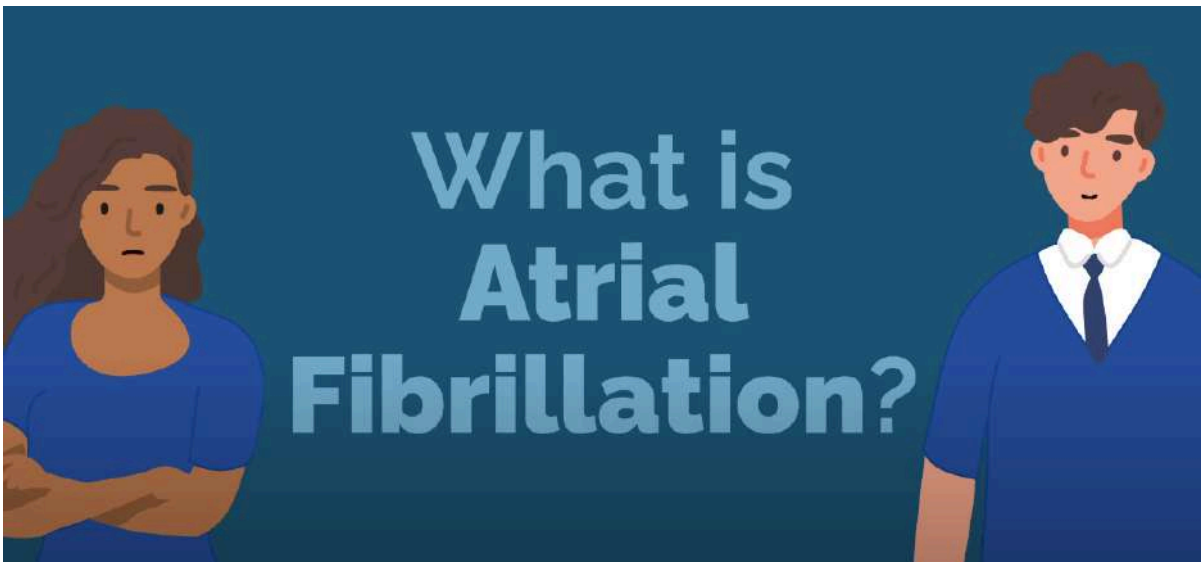
Welcome to the seventh newsletter of the PersonalizeAF! The objective of this publication is to keep all our public updated with all information and main ongoing activities while our project is under way.

Do not miss it and stay tuned for all the updates of the Early Stage Researchers' work, new conferences, papers, and other news!

And don't forget to suscribe to our social media.

PersonalizeAF, the project bringing universities, hospitals and companies from all over

Europe together to tackle Atrial Fibrillation



What is Atrial Fibrillation?

Atrial fibrillation (AF) is a condition that causes an irregular and often abnormally fast heart rate. With different manifestations in each patient, it causes a worsening quality of life and a drastic reduction in life expectancy. Today, it is the most common cardiac arrhythmia, affecting more than 6 million Europeans and its prevalence is expected to double in the next forty years. Moreover, its cost exceeds 1% of European healthcare budgets (13.5 billion per year).

To reverse these figures - or at least reduce them - experts agree on the need to promote individualised patient management by personalising cardiovascular therapies.

What does PersonalizeAF network do?

PersonalizeAF addresses this challenge by delivering an innovative multinational, multi-sectorial, and multidisciplinary research and training programme in new technologies and novel strategies for individualized characterization of AF substrate to and increase treatments' efficiency.

This initiative involves European universities, hospitals and companies researching atrial fibrillation from different fields. Using artificial intelligence, signal processing and stem cell research, PersonalizeAF brings together engineers, clinicians and biologists to improve treatments, develop new diagnostic methods and optimise patient management.

From the research point of view, PersonalizeAF will integrate data and knowledge from in-vitro, in silico, ex vivo and in vivo animal and human models to:

1) generate an individual description of the state of the atrial muscle identifying the disease mechanisms and characteristics;

2) understand the potential effect that different therapies have on different atrial substrates; and

3) combine this information to generate a specific profile of the patient and the best therapy for each patient.

With this purpose, PersonalizeAF partnership aggregates relevant scientific staff from the academic and clinical world with highly specialised biomedical companies which will be involved in a high-level personalised training programme that will train a new generation of highly skilled professionals and guarantee ESRs and future PhD students outstanding Career Opportunities in the biomedical engineering, cardiology services and medical devices sectors.

PersonalizeAF project updates

Our 15 ESRs and their research projects

The 15 Early Stage Researchers have been working full-time in their projects around all Europe for 3 years, involved in different sectors: academia, clinics and industry. Each of them has been working in his/her individual PhD, but work also collaboratively with the same purpose, improving the paradigma of Atrial Fibrillation patients in Europe from a translational perspective.

In this last newsletter, the ESRs have shared with us the overview of their whole projects and the main achievement during these years

- **ESR3: Eric Invers- Hospital Clinic de Barcelona** (Spain):

If there is something I did during the three years of the PersonalizeAF, it is learning, evolving and growing. Being able to work and collaborate with some of the most important researchers in cardiac arrhythmias is something undescribable. The passion, the methodology and the creativity of these scientists is something I want to take with me in my future career.

In addition, apart from taking, I like to think that I also helped in giving something to the research community. I was capable of helping in the processing of intracardiac signals, magnetic resonance images and clinical applications of electrocardiographic imaging in atrial fibrillation.

My main achievement during these years was in understanding the clinical applications of non-invasive tools to assess the efficacy and effectiveness of atrial fibrillation ablation

- **ESR7**, **Cristian Barrios** at Karlsruhe Institute fur Technology (Germany):

During my time with the consortium, I learned a lot as a researcher. I gained new knowledge and skills and met many great academics. I also got better at writing and presenting skills. Handling several projects at once and managing my time in a busy schedule helped me deal with stress too

Being part of the team of Early Stage Researchers (was amazing. We supported each other and learned together. I also worked closely with colleagues at my host institution, KIT, attending conferences and helping write scientific papers. This experience will stay with me and make me better in my future career.

During my PhD, I had the opportunity to develop a new method for cardiac modeling of electrophysiology, which I believe may offer some potential advancements for the field and inspire further exploration in future research endeavors.

- **ESR8**: **Thomas Hutschalik-** NCARDIA Services (The Netherlands)

My PhD journey with PersonalizeAF has been a very fulfilling and educative experience. Many moments and people have enriched the years during which I have been a part of the consortium and had the privilege to participate in researching atrial fibrillation. I would just like to list some highlights to give an impression of a few captivating years.

Firstly my work at Ncardia researching coculture models using stem cell derived cells had been blessed with many successes. I am proud of the differentiation protocols and models we developed and used to research macrophage-related effects on the emergence of atrial fibrillation. Especially satisfying has been being able to work with engineered, 3D tissues of heart muscles, a topic that had fascinated me even before I started to study medical engineering and is one of the reasons I chose this field in the first place. My research work has been presented at many conferences (ISSCR 2023, ESC 2023, ISSCR São Paulo Symposium 2023) and has also received a few recognitions of which I am very proud, including a poster prize at the ESHR 2022 in Berlin and winning a pitch competition of the Falling Walls pitch competition series.

In this regard I owe a lot to PersonalizeAF. I have been blessed with working at 4 different labs in 3 countries throughout the course of my PhD, meeting many accomplished academics and just as many friends as well. I will fondly remember our regular meetings, which were filled with engaging presentations, discussions and happy times. I will often look back on spending time together traveling in Italy, staying at the beach in Bordeaux, partying in Oslo or sitting in a bar in Valencia. I appreciate having so many experienced scientists to call upon in our network and so many fellow PhDs to share the joy and sometimes burden of pursuing our path. One aspect I would like to highlight, which will stick with me looking back, is a sense of humility. I remember hearing the stories of AF patients in Bologna and being made cognisant of how my research, once it will have run its course, will not give any immediate solution to the disease they are burdened with. It is normal for all of us to start with high aspirations on our journey of research, in our imagination a big discovery will have a great and lasting impact. Discussing with the patients, other PhDs and researchers recontextualised this a lot. Many smart people and more smarter than me people are working on a topic and most we can hope for is to add a little and at times nothing of value. At the end of the PhD I have found much humility and hope to have contributed a little in the end.

My heart goes out to all the great people who have been involved with PersonalizeAF over the years.

I think my main achievement was establishing a robust set of protocols and models that contributed to finding new mechanistic understanding of possible causes of AF. My hope is that the developed tools (differentiation protocols, high throughput 3D models, coculture model) will find other uses by future researchers who will push our gain of knowledge even further.

- **ESR10**: **Narimane Gassa-** University of Bordeaux (France)

Cardiovascular disease is the world's leading cause of death. They represent a group of conditions that affect the heart and blood vessels, including coronary heart disease, heart failure, arrhythmias and valvular disease, among others. Understanding and addressing cardiac arrhythmias are crucial for managing cardiovascular health and preventing more severe complications. Therefore, there's a need for accurate diagnostic tools and targeted interventions, such as cardiac ablations, to address these conditions effectively.

Our research is focused on the field of heart electrophysiology, where we employ multiscale mathematical models from ion channels via cells to tissues and organs. The prime objective is to leverage numerical methods in order to improve patient care in cardiac medicine, specifically for the non-invasive characterization of ectopic arrhythmias.

For this purpose, we delved into the study of electrocardiographic imaging (ECGI), a well-established technique that has evolved over the years and shows significant potential to advance safe cardiac mapping. Despite its limitations, some of which we have also investigated, ECGI remains a valuable tool in our exploration of improved mapping methods.

In our pursuit of more innovative and accurate solutions, we introduced a novel approach that shifts from the conventional ECGI methodology offering a more tailored and patient-specific workflow. This new method revolves around the use of personalized propagation models with a trade-off between good accuracy and computational efficiency making it feasible for the workflow to be integrated into a clinical time frame.

My primary accomplishment during my dPhD was the proposal of a refined Electrocardiographic Imaging (ECGI) technique leveraging patient data, as well as the development of a clinical AI-enabled remote monitoring application for Implantable Cardiac Devices.

- **ESR11: Carlos Fambuena Santos** Universitat Politècnica de València (Spain)

During my PhD within the Horizon 2020 program, I have been deeply involved in refining diagnostic strategies for Atrial Fibrillation (AF) treatment through the use of Electrophysiology Cardiac Imaging (ECGI). My work has centered on three main areas: detecting reentries, analyzing dominant frequencies, and estimating conduction velocities in patients with AF. This comprehensive approach aimed to enhance the understanding and treatment of AF by leveraging advanced imaging technologies.

A key achievement of my research was the development of an innovative algorithm that significantly improved the detection of reentries, which are critical in understanding the mechanisms of AF. This work not only provided new insights into patient stratification prior to invasive procedures but also received recognition in prestigious cardiology congresses, highlighting its impact on the field.

- **ESR13**: **Sergio Nabil Gadur-** SIMULA (Norway)

I conduct atrial blood flow simulations in the left atrium to study the hemodynamic patterns because clotting is initiated in the left atrial appendage and the current stratification risk of atrial fibrillation (AF) patients does not account for the mechanisms of clot formation. Therefore, including fluid mechanic simulations of the heart seems necessary to improve the stratification of the severity of AF patients. To perform this numerical analysis, I developed a pipeline to compute plausible atrial blood flows by using patient-specific medical images and accounting for blood viscosity changes through a non-Newtonian rheology model, a constitutive equation that links blood viscosity with its shear rate.

The PersonalizeAF project played an important role in my education and has perfected my experience on how to work within a multidisciplinary and international project. Specifically, I faced the challenge of delivering scientific presentations during our consortium meetings to a scientific audience with completely different backgrounds than mine. Also, I took advantage of the well organized secondments in Barcelona, Spain; Freiburg, Germany; and Cesena, Italy.

My main achievement during my PhD was to demonstrate that the use of a non-Newtonian rheology model is necessary to compute plausible atrial blood flows. I found that there is a correlation between the hemodynamic indices computed under a Newtonian assumption and a non-Newtonian rheology model in the left atrium body. However, this correlation does not exist in the appendage, seemingly showing that a non-Newtonian rheology model is necessary.

- **ESR14: Victor Gonzalves Marqués** - Maastricht University (Netherlands):

During these past years, I worked at the Maastricht University with computer models, exploring their use as a means to develop and test new treatments for atrial fibrillation patients. I investigated the repetitiveness of conduction patterns as a characteristic that enables the location of organized patterns during AF, developing a strategy to conduct mapping procedures with that in mind, and testing ablation outcomes of that approach. Meanwhile, I worked to develop the models to better reflect the variability of patients, enabling more comprehensive studies in the future that account for patient-specific characteristics.

This work was only possible due to the collaboration with other members of the PersonalizeAF consortium. Even with the challenges of an online secondment, my colleagues at the Università della Svizzera Italiana helped me learn the computer modeling skills required for this work, and participated in the discussions of all my PhD research. The improvement of the new models would not have been possible without the data and help from people at ADAS 3D and Hospital Clinic Barcelona. Finally, spending some time at the University of Oxford opened my mind to new types of research that can be done with computer models and with pharmacological therapy.

Ultimately, my main achievement was to conclude the PhD. This means that I learned how to be a researcher and manage myself and my resources to try and answer some interesting questions about AF. Scientifically, my work showed that there is room for improvement in current mapping techniques, that hopefully can be applied in the clinics to improve ablation therapies

If you want to get to know the Early Stage Researchers way better and their pathway, stories and experiences, click here

One important lesson that has been learned during the PhD

Here, we'll delve into a fundamental question: What is one important lesson learned during the PhD journey? We've reached out to various of our ESRs to gather their valuable insights and experiences. From personal challenges to academic discoveries, each response offers a unique glimpse into the transformative journey of doctoral studies. Join us as we explore the wisdom shared by these accomplished individuals, offering inspiration and guidance to fellow scholars and aspiring researchers alike. Let's dive in!

ESR3, Eric Invers: "An important lesson I learned during the PersonalizeAF project is that, although collaboration is difficult to achieve due to different levels of knowledge, it is very important to have interdisciplinary teams in order to move forward further away."

ESR7, Cristian Barrios: "One important lesson I learned during my PhD was the value of teamwork. I had a great experience collaborating with others on a research project. Working together with my colleagues really helped to make our research better. They had different ideas and perspectives that I wouldn't have thought of on my own. This collaboration taught me that when we work together, we can achieve more and come up with better solutions than if we work alone"

ESR8, Thomas Hutschalik: "One lesson I learned for myself is that many positive opportunities will hinge on your self-initiative. How much sponsoring you receive from your supervisor or just lucky coincidences you will stumble upon will naturally vary. But if you wish to pursue a specific aspect during your PhD or want to engage in a specific activity you will have to push for it yourself. Be that attending a conference, following a specific research topic, participating in a competition or something completely different (science communication event, startup collaborations, art projects,...). In the rarest cases someone will push you to do something that you're interested in. Go out and go for it yourself."

ESR10, Narimane Gassa: "One important lesson, The value of a Ph.D. comes from the learning - Self-care is important"

ESR11, Carlos Fambuena: "Science is never as easy as you planned at the beginning of your project."

ESR13, Sergio Nabil Gadur: "Resilience is the most important lesson/skill acquired during my PhD."

ESR14, Victor Gonçalvez: "Endurance is the key not only to finishing the PhD, but to any task or research that may impact the world around you."

Publications in Journals and Conferences

We are glad to announce that we some of the ESRs and supervisors have also submitted journal papers related to the PersonalizeAF network. and you can find the journal papers submitted in our Open Access repository, Join the ZENODO PersonalizeAF Community!

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Marie Curie H2020 Programme: Opinions and Recommendations

In this section, we'll be sharing the insights and recommendations from the ESRs directly benefited from the esteemed Marie Skłodowska-Curie Actions (MSCA) under the Horizon 2020 framework.

The MSCA H2020 Programme stands as a cornerstone in promoting research excellence and international collaboration within the European Union and beyond. Through various funding schemes, fellowships, and training opportunities, the programme supports researchers at all stages of their careers, fostering innovation and knowledge exchange.

Let's delve into how this program has shaped research, career development, and innovation, and explore valuable suggestions for its future fellows.

- The H2020 program was an amazing experience that brought me to more places than I ever imagined. Collaborating closely with leading researchers in the AF field within the same working group not only demystified their work but also established invaluable connections that integrated me into the scientific community. Moreover, working together with the other 14 ESRs going through very similar challenges and being able to share my experiences with them was a great support to get through the PhD. An essential aspect for new ESRs to consider is the extensive travel required by the program. For those relocating from distant places, often from other continents, juggling the demands of establishing a new home in a foreign country alongside

frequent travel proved challenging and often stressful. Unlike European candidates with a stable base nearby, international ESRs face the added complexity of being far away from their support networks, which significantly impacts their experience. However, despite the challenges, this unique experience is one I cherish deeply. Traveling to diverse locations exposed me to various research and life perspectives, offering invaluable insights and shaping my personal and academic journey in profound ways.

- Participating in the Horizon 2020 Marie Curie Actions was a transformative experience that significantly shaped my academic and professional journey. This program offered me not just the funding necessary to pursue my research without financial concerns, but also the unique chance to work in diverse international environments, enriching my work and widening my perspective. It emphasized developing a broad skill set beyond my research focus, including project management and communication, which I found invaluable for my career development. My time in the program taught me the importance of embracing interdisciplinary opportunities, efficiently managing my projects, and finding a balance between my professional endeavors and personal life. Engaging with the program's extensive network opened doors to collaborations that were instrumental in my growth. Reflecting on my experience, I see how it prepared me for making meaningful contributions to the scientific community and equipped me with the tools necessary for a versatile career path.

- My experience with the H2020 Marie Curie program has taught me the importance of curiosity beyond my field. Exploring diverse subjects has enriched both my research outcomes and personal growth, fostering creativity and innovation. Embracing curiosity as a guiding principle has proven invaluable for collaboration and problem-solving, making for a more fulfilling research journey within the program and beyond. This interdisciplinary approach has not only enhanced the quality of my research but also equipped me with a holistic understanding that is invaluable for collaboration and problem-solving in today's complex world.

- I think the Marie Curie programme is the gold standard when it comes to pursuing a PhD. The programme is set up to have you interact with other researchers from the start, develop a network and expose you to other research fields intersecting with your own work. Additionally the research stays (secondments) enable you to experience different countries, labs, work culture and research environments. Finally, the funding allows you to focus on your research without having to worry about your lab or personal finances. I personally think that through the EU funding schemes

many issues that one could face during your PhD (isolated research environment, singular point of supervision, lack of training and funding) are all effectively addressed. I would recommend to any young researcher being interested in pursuing a PhD to give the Marie Curie programme a close look.

- The Horizon 2020 Marie Skłodowska-Curie Actions program is an exceptional opportunity for early-stage researchers (ESRs) to develop their skills, and enhance their career prospects within the European Union and associated countries. To my point of view the strengths of such a program are: Interdisciplinary Collaboration; Opportunities for training and career development through structured research and transferable skills training; Networking and Mobility. However, while the abundance of training programs is undoubtedly beneficial and insightful, the requirement to complete compulsory courses in our host institutions, can occasionally become repetitive and may impact the progression of research. Perhaps a more strategic approach to scheduling these courses, such as concentrating them during the summer months, could be more conducive to research continuity. Additionally, regarding secondments, it would be advantageous to have the flexibility to change institutions if the evolving objectives or scope of the research project align better with a different host institution. This flexibility would enable researchers to adapt more readily to shifting research priorities and optimize the outcomes of their projects.

- Being part of a multidisciplinary, international project was a fruitful experience, not only for my academic growth, but also cultural, social and linguistic improvement.

- The Marie-Curie H2020 programme is an outstanding opportunity to jump into the science and research world. Being able to learn from different areas of knowledge in situ, by doing secondments at pioneering institutions, is something remarkable and that helps you in defining where and how you want to develop your career.

PersonalizeAF addresses Atrial Fibrillation: Papers

In this section, the consortium wants to share some of the papers published addressing Atrial Fibrillation in th scope of the project. Check them out in order to learn more about Atrial Fibrillation, stem cells, image processing, cardiac modelling, etc!

"Diffusion Reaction Eikonal Alternant Model: Towards Fast Simulations of Complex Cardiac Arrhythmias" by C. Barrios et al

"Local conduction velocities determined by non-invasive electrocardiographic imaging predict arrhythmia-free survival after pulmonary vein isolation" by E. Invers et al

"HIPSC model reveals M1 macrophages cause atrial arrhythmia correlated to electrophysiological remodelling of atrial cardiomyocytes in 2D and 3D engineered heart tissue" by T. Hutschalik et al

"Spiral Waves Generation Using an Eikonal-Reaction Cardiac Electrophysiology Model" by Narimane Gassa et al

"AF driver detection in pulmonary vein area by electropcardiographic imaging: Relation with a favorable outcome of pulmonary vein isolation" by C. Fambuena et al

"A novel sequential endocardial mapping strategy for locating atrial fibrillation sources based on repetitive conduction patterns: An in-silico study" by V. Gonçalves et al

"Patient-specific left atrium contraction quantification associated with atrial fibrillation: A region-based approach" by S. Hussain et. al.

"in-Silico TRials guide optimal stratification of ATrIal FIbrillation patients to Catheter Ablation and pharmacological medicatION: The i-STRATIFICATION study" by A. Dasi et. al.

PersonalizeAF goodbye and thanks!

And so we come to the end (of this part) of the adventure!

We want to take a moment to thank the amazing researchers of Personalize, you, our dear readers, and everyone who has been part of this journey over the past four years.

To the researchers: Thank you for inspiring us with your dedication and for pushing the boundaries of science.

To our readers: Thank you for joining us on this ride, for your curiosity, and for being part of our community.

And to everyone else involved: Whether you were a partner, collaborator, mentor, or supporter, your contributions have made a difference, and we're grateful for your presence.

As we say goodbye, let's cherish the memories, the knowledge gained, and the connections made, and the future opportunities!

Here's to new beginnings and continued adventures!

PersonalizeAF Youtube Channel

Last blog entries and News

January 19, 2024

Final PersonalizeAF meeting in Valencia

Final PersonalizeAF meeting in Valencia This is not a goodbye but a see you later! Hey, PersonalizeAF enthusiasts! We’re here to rewind the…

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April 4, 2023

Working (and travelling!)

Working (and travelling!) The combination of research and globetrotting in MSCA Hola a tothom! How is it going? Yes, yes, I'm still alive.…

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March 15, 2023

PersonalizeAF Project Raises Awareness for Atrial Fibrillation and launches a new video

PersonalizeAF Project Raises Awareness for Atrial Fibrillation and launches a new video With the occasion of the European Day for the Prevention of…

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Personalize AF

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