CALL FOR APPLICANTS

THE PROJECT

PersonalizeAF Innovative Training Network (ITN), funded by the European Commission's Horizon 2020 Marie Skłodowska-Curie programme, is looking for 15 highly motivated Ph.D. candidates. The applicants should hold an MSc degree in Engineering, Computer Science, Physics, Applied Mathematics, Biology or Medicine. The selected candidates will be employed as Early Stage Researchers (ESR).

PersonalizeAF targets to deliver an innovative multinational, multi-sectorial, and multidisciplinary research and training programme in cardiac genetics, cardiac ion channels, stem cells, signal and image processing, computer modelling and patient management with the focus to investigate AF mechanisms with a translational-oriented approach, develop more effective therapies aiming at terminating the disease mechanisms, and finally personalize AF treatments. To achieve it, PersonalizeAF aggregates relevant scientific staff from 11 academic institutions, 5 university hospitals and 5 industrial partners that will guarantee PersonalizeAF's ESRs and future PhD students following the same tracks outstanding Career Opportunities in the biomedical engineering sector and beyond.

PersonalizeAF will offer an Innovative Training Network program in which Ph.D. research activity and Academic formation are complemented by an international and intersectorial secondments, workshops and summer schools, providing each ESR employed in the network with a wide intersectional and interdisciplinary background.

REQUIREMENTS

Before considering your application, please check if you meet the requirements:

- ✓ ESRs shall be in the first four years at the time of recruitment (full-time equivalent research experience) of their research careers and HAVE NOT been awarded a doctoral degree.
- ✓ All nationalities are accepted, but researchers MUST NOT have resided or carried out their main activity in the country of their host organization for more than 12 months in the 3 years immediately before the recruitment (short stays, such as holidays, are not taken into account).
- ✓ Commitment of the fulfilment of a **Personal Career Development**. ESR's work will be regularly monitored.
- ✓ One Masters Degree in a relevant discipline, depending on the ESR position (positions available from page 3 and on).
- ✓ Applicants must show their ability to understand to understand and express themselves in both written and spoken English.

USEFUL INFO

- ⇒ The starting date (date of recruitment) of most fellowships will be **July 1st 2020..**
- ⇒ In addition to their individual scientific projects, all fellows will benefit from further continuing education, which will include secondments.
- ⇒ The gross salary will variate depending on the country destination, but following Marie Curie fellowship standards. It will include mobility and family allowance if

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applicable. More information about this: https://ec.europa.eu/research/mariecurieactions/sites/mariecurie2/files/msca-if-fellows-note_en.pdf

⇒ It is possible to apply to more than one fellowship, specifying the order of preference in the dedicated section of the application form.
⇒ The contract will last 36 months.
⇒ ESRs will be employed full-time.
⇒ ESRs must be working exclusively for the action.
⇒ ESRs will participate in the events organized by the Consortium members.

APPLICATION

Applications MUST be sent to the coordinator e-mail personalizeAF@itaca.upv.es .

All applicants must be sure to provide the following documents:

- Application Form
- Letter of motivation
- Copies of degree and academic transcripts (with grades and rankings)
- Summary of Master's thesis (max. 1 page)
- Short CV including a publication list (if any)
- Contact details of two Academics which will provide reference letters
- Proof of language skills (if any)
- Passport copy

THE FINAL DEADLINE FOR ALL APPLICATIONS IS **APRIL 15TH 2020**

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ESR FELLOWSHIPS

ESR1	"Prediction of drug effect on tissue arrhythmogenicity by hi-IPSC in vitro model"
Host Institution	Fundación para la investigación Biomédica del Hospital Gregorio Marañón. Spain
PhD Programme	"Technologies for Health and Wellbeing" PhD Programme at Universitàt Politécnica de Valencia.
Expected Results	We will create an in-vitro workbench platform to evaluate the key features of atrial remodelling by analysing the transcriptome of AF patients and to reproduce the arrhythmic effects of pharmacological compounds. Then, we will correlate the drug responses with their key genetic/transcriptomic biomarkers on the in-vitro model and in patients.
Objectives	The aim of this project is to develop an in-vitro workbench for drug screening by developing a population of hiPSC-derived atrial cardiomyocytes that account for the interpatient variability in cardiac ion channels due to genetic/transcriptional factors. This population of models will be used for testing the arrhythmia inducibility after administration of drugs by analysing the electrophysiological behaviours and to determine patient biomarkers that can predict drug response and plan a personalized AF therapy.
Planned secondments	**3; GenomeSCAN** genome/transcriptome sequencing, **NCARDIA** culture and characterization of hiPSC-aCM cultures. **The University of Oxford**, correlation between genetic/transcriptomic biomarkers and drug response.

ESR2	"Impedance characterization for scar and fibrosis detection."
Host Institution	Karlsruhe Institute of Technology. Germany.
PhD Programme	"Electrical Engineering and Information Technology" PHD Programme in at Karlsruhe Institute of Technology.
Expected Results	A multi spectral impedance measurement system and catheter will be developed and used to study the relation between the different tissue mutation of the myocardium, especially scar and fibrotic, as means to better characterize the tissue
Objectives	Regions of scar and fibrotic tissue have been identified as a potential driving region of arrhythmic activity during AF. High density mapping in the Electrophysiology Lab (EP-Lab) can deliver important information about areas of low voltage and slow conduction, both characteristics of these driving areas. Impedance measurement can be practically implemented on intracavitary recordings and provide the information required to locate these regions, as changes in conductivity may indicate alterations in myocardium functionality.
Planned secondments	**3; Université de Burdeux** signal processing for intracardiac fibrosis identification, **Institut d'Investigacions Biomèdiques August Pi I Sunyer** clinical evaluation of fibrosis, **ADAS3D** software for clinical evaluation of fibrosis.

ESR3	"Non-invasive detection of atrial fibrosis to refine the antiarrhythmic therapy in patients with atrial fibrillation"
Host Institution	Institut d'Investigacions Biomèdiques August Pi I Sunyer. Spain.
PhD Programme	PHD Programme "Medicine and Translational Research" at IDIBAPS
Expected Results	To create an improved therapeutic approach to AF patients by integrating data on atrial fibrosis burden and topography, by an algorithm to non-invasively characterize atrial fibrosis in cardiac magnetic resonance imaging. Validation in humans will be performed in patients undergoing AF ablation.
Objectives	Myocardial fibrosis has been recognized as a hallmark of the AF substrate that drives the arrhythmia instauration and progression. Currently, there is a lack of consistent and reproducible clinical tools to evaluate the presence of atrial fibrosis; therefore, such an extensive knowledge in the experimental field remains clinically useless. In this project, we aim at developing, validating and testing the efficacy in the clinical practice of a non-invasive imaging method to assess atrial fibrosis, thus enabling the individualization of the therapeutic approach in patients with AF
Planned secondments	**3; Maastricht University** development of animal models with chronic AF. **Universitaets-Klinikum Freiburg** develop a model for dense or interstitial fibrosis by coculturing cardiomyocytes with various densities of fibroblasts, and to learn recording techniques in tissue slices from atria of normal and fibrillating atria. **ADAS3D** Integration into ADAS3D medical software.

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ESR4	**"A framework to quantify the 3D left atrium wall motion model on a patient specific basis, in atrial fibrillation patients"**
Host Institution	Università di Bologna. Italy.
PhD Programme	"Biomedical, Electrical and Systems Engineering" PhD Programme at Università di Bologna.
Expected Results	We expect to design and develop a novel approach for a personalized LA motion estimation based on the application of advanced image segmentation and registration techniques in order to automatically compute the patient-specific LA deformation throughout the cardiac cycle in AF patients.
Objectives	In view of a personalized approach for AF, the availability of a realistic model of left atrial (LA) motion is one of the main open issues to ensure a realistic 3D patient-specific model of the left atrium. The assessment of the LA motion in sinus rhythm and AF is a key factor contributing towards a comprehensive understanding of AF mechanisms, treatment outcome improvement and complication prediction. The aim of this project is the development of an automatic procedure in order to compute the patient specific LA wall motion model and use this information to predict clot formation.
Planned secondments	4; **Institut d'Investigacions Biomèdiques August Pi I Sunyer** quantification of flow phenotypes with in vivo measurements. **ADAS3D**, atrial shape quantification, **Universitaets-Klinikum Freiburg**, clinical management of anticoagulation. **Simula Research Laboratory**, integration of 3D motion model and the computational workflow developed to simulate blood flow and predict clot formation.

ESR5	**"A clinical measurement framework to improve non-invasive quantification of individual atrial conduction characteristics in patient with atrial fibrillation"**
Host Institution	Maastricht University. The Nethederlands.
PhD Programme	"Health, Medicine and Life Sciences" PhD Programme at Maastricht University.
Expected Results	The results of this project will be a tool that integrates intracardiac measurements with computational cardiac modelling and non-invasive quantification of atrial conduction characteristics. A software package for non-invasive and personalized assessment of AF substrate complexity and long-term treatment outcome prediction will be obtained from this project.
Objectives	The aim of this project is to develop a multi-scale measurement framework for patient-specific non-invasive assessment of conduction characteristics and the degree of electro-structural remodelling in patients with AF. A combined approach will be implemented that joins clinical measurement data with computational modelling to improve the quantification of the degree of electro-structural remodelling in the atria during AF and the projection of the atrial electrical activation pattern onto the body surface. This in turn will aid in the development of novel atrial-specific signal processing techniques to arrive at more physiologically meaningful AF complexity parameters that provide an accurate characterization of the conduction properties of the atria as reflected on the torso
Planned secondments	**2; Universitat Politècnica de València**: non-invasive quantification of atrial electrical activity and AF substrate complexity by body surface potential mapping and ECGi, **EP Solutions**, reconstruction of atrial propagation patterns based on ECGi.

ESR6	**"Technologies for characterization of cardiomyocyte-fibroblast interaction in atrial fibrillation"**
Host Institution	Universitaets-Klinikum Freiburg, Germany.
PhD Programme	"Medicine" PhD programme at the Universitaets-Klinikum Freiburg.
Expected Results	Electrical activity will be measured via voltage-clamp and with voltage-sensitive dyes in freshly isolated and co-cultured cardiomyocytes and fibroblasts. Cells will be cultured under conditions of controlled mechanical forces in order to assess differences between cells derived from SR and AF tissue. In addition, we will examine tissue slices from animal/human normorhythmic or fibrillating atria as a model for cardiomyocyte-fibroblast interaction in AF. AF-induced changes in gene expression will be analysed with qt-PCR; gene products of interest include ion channels, connexins, cytoskeletal proteins related to cell coupling.
Objectives	AF leads to electrical and structural remodelling that contribute to the maintenance of the arrhythmia. Fibrosis is the hallmark of structural remodelling in AF, but little is known about how these cell types influence cardiomyocytes, and whether mechanical forces can modulate the involved processes. This project aims to study functional interaction between cardiomyocytes and fibroblasts obtained from atrial tissue of patients in sinus rhythm and AF, under conditions of controlled mechanical forces, and to simulate the results in computer models in order to find potential individualized therapeutic strategies
Planned secondments	**2; Fundación para la investigación Biomédica del Hospital Gregorio Marañón**, optical mapping of cell cultures, patient's transcriptome analysis, clinical management in AF. **NCARDIA**, drug effects on cell cultures with AF conditions

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ESR7	"Computer simulation to relate patterns of fibrosis to arrhythmogenicity"
Host Institution	Karlsruhe Institute of Technology. Germany.
PhD Programme	"Electrical Engineering and Information Technology" PhD Programme at KIT
Expected Results	We will provide an algorithm to quantify AF vulnerability for a given multi-scale model considering cellular and tissue (fibrosis) electrophysiological properties as well as the individual anatomy. We will provide a reentrant reaction-Eikonal scheme. These computer simulations will provide also evidences of the link between fibrotic markers and ablation outcomes.
Objectives	Regions of fibrotic tissue have been identified as a major contributing factor to AF, and we will identify which patterns of fibrosis will most likely lead to AF using computer modelling. We will investigate a) patches of various size, b) patches of various degree of fibrosis, c) several patches with various distance, d) patches with various degree of inhomogeneity of fibrosis, e) endocardial, epicardial and transmural patches of fibrosis. The fibrotic tissue will be implemented using a realistic 3D-model of the atria. A robust and comprehensive measure of arrhythmogenicity will be used to group the models in classes of high, medium und low arrhythmogenicity. To be able to thoroughly sample the high-dimensional parameter space, a reentrant reaction-Eikonal model will be formulated and solved by a novel numerical scheme. For the first time, this will allow to simulate fibrillation dynamics close to real-time.
Planned secondments	**3; ADAS3D**, identify fibrosis characteristics from MRI images, ; **Institut d'Investigacions Biomèdiques August Pi I Sunyer,** identify clinically relevant patterns of fibrosis, **Maastricht University** mathematical modelling of endo-, epicardial and transmural extent of fibrosis

ESR8	"Stabilization of protocol for hiPSC-derived in vitro models to study AF"
Host Institution	NCARDIA. The Netherlands
PhD Programme	PhD Programme in "Health, Medicine and Life Sciences", at Maastricht University.
Expected Results	We will generate a protocol for atrial-like cardiomyocytes and will perform extensive characterization of these cells. For this, also functional assays will be developed and optimized. Next, we will employ the hiPSC-aCMs to generate in-vitro AF models with different stages of remodelling. These in-vitro human models of AF will allow us to evaluate the whole transcriptome of hiPSC-aCM cultures under different electrophysiological scenarios in order to analyse characteristic gene expression patterns.
Objectives	The development of effective research models of chronic AF is one of the main barriers to elucidating the underlying mechanisms of this arrhythmia and enabling design of effective therapies. The aim of this project is to develop of a robust and scalable protocol for differentiation of human induced pluripotent stem cells towards atrial cardiomyocytes (hiPSC-aCM) in order to generate a novel model of in-vitro AF, including assay development to investigate the disease phenotype. When this is achieved, the protocol will be used to generate hiPSC-aCMs from patients predisposed for atrial fibrillation. The models will be used to evaluate the relation between gene expression/protein changes and functional readouts (e.g. electrophysiological modifications), as well as to screen for compounds that might reverse the disease phenotype
Planned secondments	**2; Universitaets-Klinikum Freiburg,** patch clamp of hiPSC-aCMs. **Fundación para la investigación Biomédica del Hospital Gregorio Marañón**, optical and voltage mapping of hiPSC-aCM and comparison with clinical phenotypes of remodelling

ESR9	"In-silico populations of models to predict drug effects on arrhythmogenicity"
Host Institution	The University of Oxford, United Kingdom.
PhD Programme	"Computer Science" PhD Programme of the University of Oxford.
Expected Results	To create a simulated population of mathematical models, representing the inter-subject variability, to evaluate the effect of different drug treatments (individually or in combination) on the initiation and maintenance of arrhythmias. This simulated population will also provide a correlation of the electrophysiological determinants and the pharmacological treatment.
Objectives	The aim of this project is to develop a population of mathematical models that account for the interpatient variability in cardiac ion channels. This population of models will be used for testing arrhythmia inducibility and treatment efficacy after administration of drugs by analysing the inducibility of arrhythmias by cross-field stimulation in a 3D mathematical model of human atria.
Planned secondments	**3; Karlsruhe Institute of Technology** improvement of in-silico models of atrial cells, **Fundación para la investigación Biomédica del Hospital Gregorio Marañón** incorporation of patient genetic/transcriptomic determinants in the computational model, optical mapping in cell cultures and quantification of fibrillation dynamics, **NCARDIA**, correlation between in-silico and in-vitro populations of models.

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ESR10	"Forecasting atrial fibrillation"
Host Institution	Universitè de Bourdeux, France.
PhD Programme	"Bioinformatics" PhD Programme of the Universitè de Bordeaux.
Expected Results	The doctoral project aims to introduce new mathematical approaches in order to better solve the electrocardiographic imaging (ECGI) problem. We will obtain endocardial maps (Carto, Biosense-Webster) synchronized with the ECGI system (EPSOL) in order to compare both measurements and evaluate potential improvement upon state-of the-art ECGi resolution methods.
Objectives	Our main goal is to improve the current non-invasive electrocardiographic imaging (ECGI) methodology for AF (AF) mapping. We will investigate two methods that have never been used for the ECGI inverse problem. These two methods come from the data assimilation community, and they have proven their efficiency in weather forecasting. These methods treat the inverse problem either as a static equation, which does not take into account the dynamics of the action potential wave, or as an unsteady equation modelling the propagation of the electrical activity in the heart. Our goal is to compare both methods on different types of data and to identify which method is more appropriate for solving the ECGI inverse problem compared to the state-of-the-art methods. The comparison would include both accuracy and efficiency criteria and would be performed on in silico and clinical data.
Planned secondments	**3; Simula Research Laboratory** test ECGI solutions in 3D realistic simulations. **EP Solutions,** test the new ECGI methods on EPSOL data. **Universitat Politècnica de València** post-processing of ECGI data.

ESR11	"Post-processing of ECGI to detect atrial drivers"
Host Institution	Universitat Politècnica de València. Spain.
PhD Programme	"Technologies for Health and Wellbeing" PhD Programme at Universitat Politècnica de València
Expected Results	This ESR will provide a validation of the postprocessing algorithms used in ECGI by simultaneous optical mapping data (gold standard) and simulated electrical recordings obtained on the inner surface of a tank filled with saline already available at UBx and study potential integration into EPSOL platform.
Objectives	The aim of this project is to develop reliable post-processing software that allows identifying atrial drivers on ECGI data from patients with AF. We will investigate the role of combined frequency, phase and temporal domain measurements in the determination of the atrial drivers, together with analysis of the cause-effect relationships on the propagation patterns on a database of 30 patients from FIBHGM. We will make use of convolutional neural networks to identify the most relevant parameters that allow for the identification of atrial drivers .
Planned secondments	**3; Fundación para la investigación Biomédica del Hospital Gregorio Marañón** analysis of clinical cases already available at FIBHGM. **Universitè de Bourdeux** evaluation on isolated heart database, **EP Solutions** postprocessing in EPSOL software

ESR12	"Planning ablation therapies using in-silico models"
Host Institution	Karlsruhe Institute of Technology. Germany.
PhD Programme	"Electrical Engineering and Information Technology" PhD Programme at Karlsruhe Institute of Technology. Germany.
Expected Results	This ESR will provide a novel tool based on individualized simulations to predict the success of the different therapeutic options.
Objectives	In this project, we will develop a system to leverage personalized computer models of AF patients to evaluate different ablation strategies.). A workflow will be installed to integrate clinical data measured in the EP lab into a personalized computer model that includes areas of fibrotic tissue and slowed conduction. This enables the personalized classification of arrhythmogenicity which then can be compared with the symptoms in the respective patients. The vision is to be able to create this personalized computer model while the patient is in the EP lab. Special focus will be laid on an intuitive user interface using virtual reality methods to provide an immersive and natural environment. The system will enable cardiologists to interactively evaluate ablations strategies that will most likely terminate AF and circumvent relapse
Planned secondments	**3; Fundación para la investigación Biomédica del Hospital Gregorio Marañón**, clinical ablation treatment on AF patients. **Universitat Politècnica de València**, personalization of mathematical models based on non-invasive body surface measurements during AF, **ADAS3D** development of planning platform as medical software and integration with MRI data.

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ESR13	"Prediction of thrombolytic events by personalized computational models accounting for fibrosis"
Host Institution	Simula Research Laboratory. Norway.
PhD Programme	"Mathematics and Natural Sciences" PhD Programme at Universitetet I Oslo.
Expected Results	We will develop adaptive software for estimating blood flow dynamics. Then, we will determine the key indicators that best predict clot formation by using different atrial geometries derived from human patient data.
Objectives	Develop computational models of time-varying left hearts to estimate cardiac hemodynamics correlate atrial morphological features and flow phenotypes ultimately reflecting the actual clotting mechanisms, validate the developed tools against existing AF patient cohorts and demonstrate the applicability with retrospective data and improve stroke risk stratification and treatment, distilled down to clinically interpretable and useful indices.
Planned secondments	**3; Universitaets-Klinikum Freiburg**, clinical management of anticoagulation. **Università di Bologna**, realistic 3D models including wall motion. **ADAS3D**, atrial shape quantification

ESR14	"Development of an adaptive and personalized 3D atrial simulation model to reflect patient-specific characteristics of the ECG and to predict response to anti-arrhythmic drugs"
Host Institution	Maastricht University, The Netherlands.
PhD Programme	"Health, Medicine and Life Sciences" PhD Programme at Maastricht University.
Expected Results	The results of this project will be a novel 3D simulation model that can incorporate key electrophysiological features of an individual patient, such as atrial conduction patterns during both sinus rhythm and AF, the degree of fibrosis and atrial dilation. The resulting model will be used on an observational study on at least 30 patients for whom we will simulate personalized treatment scenarios, such as pharmacological interventions in AF and compare the model predictions to the therapy outcomes (prescribed according to current guidelines).
Objectives	The aim of this project is to develop an adaptive 3D computer model of the atria that can be tuned to match the characteristics of atrial electrical activity recorded in a specific patient. The model allows for partial individualization by implementing individual anatomical and electrophysiological characteristics of a patient. This patient-specific model can be used to simulate the effect of individual pathophysiological mechanisms on the ECGs and to predict antiarrhythmic treatment outcome, thereby improving personalized non-invasive diagnosis of AF.
Planned secondments	**3; Università della Svizzera Italiana**, individualization of 3D in-silico model of atrial conduction, computational modelling of atrial electro-structural remodelling in patients with AF. **ADAS3D** MRI/CT segmentation. **University of Oxford** mathematical modelling of drug effects.

ESR15	"Multiparametric atrial fibrillation stratification"
Host Institution	Universitat Politècnica de València, Spain.
PhD Programme	"Technologies for Health and Wellbeing" PhD Programme at Universitat Politècnica de València.
Expected Results	We will first develop a software package for incorporating atrial-specific markers to the currently considered risk factors to predict success of the different therapeutic approaches employed in AF management. As a result, we will develop a decision-making algorithm to help selecting the best therapeutic option in an individual patient basis and taking into account gender related characteristics that accounts for the patient's specific atrial substrate.
Objectives	Current management of AF patients is based on patient's symptoms and risk factors, but not on the evaluation of the atrial structural or functional state. The objective of this project is to propose a stratification criterion to select the best therapeutic option in each individual patient that incorporates atrial-specific markers in the decision-making protocol. we will use machine learning methods (including incremental online-learning) to identify sub-phenotypes of AF that are associated with better response to each AF therapy
Planned secondments	**3**; **Fundación para la investigación Biomédica del Hospital Gregorio Marañón**, clinical management of AF patients, **VTECH**, electronic health records and clinical decision support software, **Universitaets-Klinikum Freiburg**, clinical management of AF patients

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