# **VIRTUAL HEART SPANISH NETWORK**





Red Española de Modelización Computacional Cardiaca





- We are a **multidisciplinar network** of Spanish universities and research centers with ample experience in modeling the heart behaviour from different point of views: electrophysiologic, mechanics or fluidics.
- We collaborate with the main Spanish hospitals and international companies





- To develop patient specific multi-scale computer heart models which can be applied to study and optimize the treatment of cardiac diseases.
- To facilitate the use of computational models in the daily clinical practice and in the development of new therapies by medical companies.

#### MULTIDISPLINARY TEAM



- Biology
- Math and Numerical methods
- Physics and Engineering (models, signals, images)
- Computers Sciences

### Cell and tissue characteristics

- In vitro electrophysiology
- Histology
- Confocal microscopy analysis: Scar tissue











#### Patient specific cardiac models I (geometry)



#### Patient specific cardiac models







- Anatomical properties (heterogeneity, anisotropy.....)
- Purkinje fiber
- Fiber direction



#### Patient specific cardiovascular models



• Mechanical and hemodynamic simulations

### Fluid-electro-mechanical model

- Alya (BSC) multi-scale simulation code
- Code efficiency and supercomputer
- Space-fractional modeling
- Fluid-electro-mechanical simulations







#### To study cardiac arrhytmias

Time = 0.0

• Ventricular Arrhythmias



Time = 0.0

- Potencial vs. Time for Node 66604 20+ 0+ -20+ -40+ -60+ -80 0 Potencial vs. Time for Node 66604 20 -0 --20 --40 --60 Potencial Potencial 20.00 -5.00 -30.00 -55.00 -80.00 -5.89 -31.78 -57.68 -83.57 200 1000 400 35 600 800 100 200 300 400 500 600 700 800 900
- Atrial Arrhythmias

Virtual Heart Spanish Network

### To optimize therapies

 Radiofrecuency ablation models to study the characterisctics of lesion formation

Model of defibrillation





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## Risk stratification and biomarkers

• Analysis of EGM and ECG signals



• Machine Learning techniques for therapy planning



Analysis of Voltage Maps





#### **MEMBERS**



• Componentes de la marca VHEARTSN

# Gracias