

## PERSONAL INFORMATION

Family name, First name: Sacconi, Leonardo  
Date of birth: 10-05-1977  
Nationality: Italian  
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## • EDUCATION

- 2001            Laurea (degree) in Physics, with the grade 110/110, at the University of Florence (Italy); title of my master thesis: «Development and characterization of a 3D magneto-optics manipulator for single molecule applications», Defence date: 28 September 2001.
- 2004            PhD in Physics, at the University of Trento (Italy); title of my thesis: «Cell Imaging and Manipulation by Non-linear Optical Microscopy», Supervisor: prof. Renzo Antolini. Defence date: 15 December 2004.

## • CURRENT POSITIONS

- 2022 –            Senior Researcher at the Institute of Clinical Physiology - National Research Council (IFC-CNR), Italy.
- 2020 –            Senior Researcher at the Institute for Experimental Cardiovascular Medicine, University Freiburg, Germany.

## • PREVIOUS POSITIONS

- 2020 – 2022      Senior Researcher at the National Institute of Optics - National Research Council (INO-CNR), Italy.
- 2011 – 2020      Researcher at the National Institute of Optics - National Research Council (INO-CNR), Italy.
- 2019            Visiting scientist, Department of Physiology, Mc Gill University, CAD (Group leader: prof. Gil Bub).
- 2005 – 2010      Post-doc at the European Laboratory for Non-Linear Spectroscopy, Italy (Group leader: prof. Francesco S. Pavone).
- 2004 – 2005      Post-doc at the School of Applied & Engineering Physics, Cornell University, Ithaca, NY, USA (Group leader: prof. Watt W. Webb).

## • SCIENTIFIC RESEARCH

My laboratory develops innovative optical imaging methodologies to increase the understanding of cardiac physiology. Random access multi-photon microscopy was developed and used to simultaneously measure action potentials and intracellular calcium transients at multiple sites within the sarcolemma in health and diseased cardiac cells. Taking this work to another order of magnitude, our lab is also investigates action potential propagation at the whole heart level. In this respect, we developed an optical system capable of mapping and controlling the action potential propagation in perfused hearts. The system was implemented with a digital micromirror device capable of drawing arbitrarily-chosen stimulation patterns allowing precise epicardial optogenetic stimulation. Recently, a real-time manipulation of the propagating electrical wave-front has been demonstrated, opening the prospect for real-time resynchronization therapy and cardiac defibrillation. Functional studies are also combined in a correlative manner with whole heart cytoarchitecture. We combine advances in light-sheet microscopy, tissue clearing (CLARITY/SHIELD based), and immunostaining to reconstruct the three-dimensional organization of the cardiac conduction system in the whole mouse heart.

## • TEACHING ACTIVITIES

- 2017 –            Professor of Biophotonics in the International Doctorate of in Atomics and Molecular Photonics at European Laboratory for Non-linear Spectroscopy, Florence, Italy.
- 2014 –            Professor of Physics for the Bioengineering, Faculty of Engineering of University of Florence, Florence, Italy.
- 2008 – 2014      Professor of Physics, Faculty of Agriculture of University of Florence, Florence Italy.

- **SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS**

2011 – 8 Post-doc / 7 PhD students / 12 Master Students

- **INSTITUTIONAL RESPONSIBILITIES AND EDITORIAL ACTIVITIES**

2022 – Associated Editor of *Frontiers in Physiology*.

2021 – Member of Doctoral Committee of the PhD Program in Biomedical Sciences at the University of Florence.

2018 – 2021 Member of Doctoral Committee of the Department of Physics of the University of Florence.

2018 – 2022 Nucleus member of the Working Group on Cardiac Cellular Electrophysiology of the European Society of Cardiology.

2018 – Associated Editor of *Progress in Biophysics & Molecular Biology*.

2017 – 2022 Member of Council of the National Institute of Optics.

2016 – 2020 Coordinator of Nano & Biophonic research field of the National Institute of Optics.

- **COMMISSIONS OF TRUST**

- Expert evaluator of German Research Foundation (DFG).
- Expert evaluator of Czech Science Foundation.
- Expert evaluator of Research Foundation Flanders.
- Expert evaluator of European Research Council (ERC).
- Expert evaluator of HORIZON 2020 FET-OPEN.
- Expert evaluator of the European Science Foundation College of Expert Reviewers.
- Expert evaluator of Dutch Heart Foundation.
- Expert evaluator of PMO projects of Ministry of Economic Development (MISE).

- **SELECTED INVITED PRESENTATIONS**

- “Optical recording of electrical activity in intact neuronal networks with random access second-harmonic generation microscopy”, Forum of European Neuroscience (FENS), Geneva, Svizzera (2008).
- “Brain plasticity and functionality explored by non-linear optical microscopy” Lasers and Applications in Science and Engineering at SPIE Photonics West, San Francisco, US (2010).
- “Probing the spatiotemporal relationship between intracellular  $Ca^{2+}$  release and action potential propagation in cardiomyocytes by ultrafast multi-photon random access microscopy” BiOS at SPIE Photonics West, San Francisco, US (2013).
- “Optical recording of action potential propagation in transverse-axial tubular system” International Union of Physiological Science (IUPS), Birmingham, UK (2013).
- “Towards a Comprehensive Understanding of Brain Structure by Correlative Microscopy” Optics and the Brain at Optics in the Life Sciences, Vancouver, Canada (2015).
- “Optical dissection of cardiac electrical activity” in *Frontiers in CardioVascular Biology*, Florence, Italy (2016).
- “Advances optical methods to monitor and control the cardiac electrical activity” 17<sup>th</sup> International European Light Microscopy Initiative Meeting, Dubrovnik, Croazia (2017).
- “Real-time optical manipulation of conduction in intact hearts” Gordon Research Conference on Cardiac Arrhythmia Mechanisms, Lucca, Italy (2019).
- “Random Access Confocal Microscopy for Cardiac Research” 8<sup>th</sup> International Workshop on Cardiac Mechano-Electric Coupling and Arrhythmias, Freiburg, Germany (2019).
- “Micron-scale imaging and targeting: protein location-function relationships” ESC Congress, (2020).
- “Advanced optical methods to monitor and control the cardiac electrical activity” - State of the art lecture - 23<sup>o</sup> Congresso Nazionale SIRC (2021).
- “Optogenetic manipulation of cardiac electrical dynamics using sub-threshold illumination: dissecting the role of cardiac alternans in terminating rapid rhythms” 2<sup>nd</sup> Optogenetic Technologies and Applications Conference (2021).

- **ORGANISATION OF SCIENTIFIC MEETINGS**

2016 Symposium organizer in *Frontiers in CardioVascular Biology (FCVB)* meeting: “Advances in imaging technology for cardiac research”, 08-10 July, Florence, Italy.

2018 Symposium organizer in National Congress of Italian Physiological Society: “Advanced optical methods for morpho-functional investigations”, 19-21 September, Florence, Italy.

- 2018 Member of scientific and organizing committee of the international workshop NOTICE: Novel optics-based approaches for cardiac electrophysiology, 21-22 September, Florence, Italy
- 2019 Member of organizing committee of the Nanoengineering for Mechanobiology meeting 24-27 March, Camogli, Genova, Italy.
- 2022 Member of scientific committee of the international workshop NOTICE Glasgow 2023. 20-21 April, Glasgow, Scotland.

- **INTERNATIONAL AWARDS**

- The American Society For Cell Biology PreDoctoral - Travel Award 2003
- Outstanding Achievement Award 2017 from European Society of Cardiology (ESC)
- EMBO Short-Term Fellowship 2018

- **SELECTED NEWS AND EDITORIALS**

- PRESS RELEASE: “Second-harmonic imaging with minimal damage”, BIOPHOTONICS, January 2006.
- EDITORIAL: “Light relief for heart attacks”, MICROSCOPY AND ANALYSIS, January 2017.
- PRESS RELEASE: “Optical Imaging Platform Uses Light to Treat Arrhythmia”, PHOTONICS MEDIA, January 2017.
- SCIENTISTS ON THE SPOT: Cardiovascular Research Onlife talks with Dr Leonardo Sacconi, 2017 Outstanding Investigator award of the European Society of Cardiology council for Basic Cardiovascular Sciences. November 2017 (doi: 10.1093/cvr/cvx176).
- EDITORIAL: “Cardiomyocyte-specific Gq signaling and arrhythmias: novel insights from DREADD technology” Cardiovasc Res. (doi: 10.1093/cvr/cvz052).
- PRESS RELEASE: “Controlling Cardiac Waves with Light to Better Understand Abnormally Rapid Heart Rhythms” AIP PUBLISHING December 2020.
- TV show: “I segreti della luce” - Superquark: <https://www.youtube.com/watch?v=QhvH5b2bPBs>

- **FUNDINGS**

- Flagship project “NanoMAX”. 2012 - 2018.
- Telethon grant 2013 (GGP13162) “Hypertrophic cardiomyopathy caused by mutations in the thin filament regulatory proteins of the sarcomere”.
- Health Ministry Project 2011-2012 – Yang Investigator (GR) Biomedical “Atrial Dilatation as a substrate for Atrial Fibrillation in Hypertrophic cardiomyopathy: cellular mechanisms and novel therapeutic approaches”.
- FAS salute 2014 project – Tuscany Region “Monitoraggio e prevenzione delle morti improvvise cardiache giovanili in Toscana (ToRSADE)”
- Telethon grant 2016 (GGP16191) “A novel in vitro Duchenne Muscular Dystrophy cardiomyopathy model: human iPSC-derived cardiomyocytes for mechanistic studies”.
- European Flagship “Human Brain Project”. Specific Grant Agreement One (SGA1): April 2016 - April 2018; SGA2: April 2018 - April 2020; SGA3: April 2020 - March 2023.
- Telethon grant 2019 (GUP19012) “Towards Precision Medicine with Human Induced Pluripotent Stem Cells for Dystrophin Associated Cardiomyopathy”.
- H2020-EIC-FETPROACT-2019 “Restoring cardiac mechanical function by polymeric artificial muscular tissue”: September 2020 - August 2024.
- Bando Ricerca COVID 19 Toscana – Tuscany Region “PRECARVID – Studio clinico e modelli cellulari per la PREdizione e prevenzione del rischio CARdiovascolare in pazienti coVID-19”: May 2021 - May 2023.
- DFG (Deutsche Forschungsgemeinschaft) grant “Advanced Structure–Function Imaging of Cardiac Trans-Scar Electrical Conduction” October 2022 – September 2025.
- Integrated Infrastructure Initiative in Photonic and Quantum Sciences “IPHOQS” - PNRR. November 2022 – October 2025.

- **PATENTS**

1. Silvestri L., Muellenbroich M.C., Sacconi L., Pavone F.S., “Sistema e metodo di misura della focalizzazione di uno strumento ottico” Patent Number: 102016000132604.

- **CITATION REPORT**

- During my career I produced 87 publications in peer review journal, 5 journal covers, and 8 book chapters that have attracted 4593 citations and producing an h-index of 38 (Google Scholar; ).

- **TEN REPRESENTATIVE PUBLICATIONS**

1. V. Biasci, L. Santini, G.A. Marchal, S. Hussaini, C. Ferrantini, R. Coppini, L.M. Loew, S. Luther, M. Campione, C. Poggesi, F.S. Pavone, E. Cerbai, G. Bub, L. Sacconi, Optogenetic manipulation of cardiac electrical dynamics using sub-threshold illumination: dissecting the role of cardiac alternans in terminating rapid rhythms. **Basic Res Cardiol.** Vol.117 (2022).
2. E. A. Rog-Zielinska, M. Scardigli, R. Peyronnet, C. M. Zgierski-Johnston, J. Greiner, J. Madl, E. T. O'Toole, M. K. Morphew, A. Hoenger, L. Sacconi, P. Kohl, Beat-By-Beat Cardiomyocyte T-Tubule Deformation Drives Tubular Content Exchange. **Circ Res.** Vol. 128 pp. 203–215 (2020).
3. M. Scardigli, C. Muellenbroich, E. Margoni, S. Cannazzaro, C. Crocini, C. Ferrantini, R. Coppini, .P Yan, L. M Loew, M. Campione, L. Bocchi, D. Giulietti, E. Cerbai, C. Poggesi, G. Bub, F. S. Pavone, and L. Sacconi, Real-time optical manipulation of cardiac conduction in intact hearts, **J Physiol** vol. 596 pp. 3841-3858 (2018).
4. M. Scardigli, C. Crocini, C. Ferrantini, T. Gabbrielli, L. Silvestri, R. Coppini, C. Tesi, E. A. Rog-Zielinska, P. Kohl, E. Cerbai, C. Poggesi, F. S. Pavone, L. Sacconi, Quantitative assessment of passive electrical properties of the cardiac T-tubular system by FRAP microscopy, **Proc Natl Acad Sci U S A** vol. 114 pp. 5737-5742 (2017).
5. C. Crocini, C. Ferrantini, R. Coppini, M. Scardigli, P. Yan, L. M. Loew, G. Smith, E. Cerbai, C. Poggesi, F. S. Pavone, L. Sacconi, Optogenetics design of mechanistically-based stimulation patterns for cardiac defibrillation. **Sci Rep.** vol. 6 pp. 35628 (2016).
6. C. Crocini, R. Coppini, C. Ferrantini, P. Yan, L. M. Loew, C. Tesi, E. Cerbai, C. Poggesi, F. S. Pavone, L. Sacconi, Defects in T-tubular electrical activity underlie local alterations of calcium release in heart failure. **Proc Natl Acad Sci U S A** vol. 42 pp. 15196-15201 (2014).
7. P. Yan, C. Acker\*, WL. Zhou\*, P. Lee\*, C. Bollensdorff\*, A. Negrean\*, J. Lotti\*, L. Sacconi\*, S. D. Antic, P. Kohl, H. D. Mansvelder, F. S. Pavone, and L. M. Loew, Palette of fluorinated voltage sensitive hemicyanine dyes, **Proc Natl Acad Sci U S A** vol. 109 pp. 20443– 20448 (2102). (\* Equally contributing authors)
8. L. Sacconi, C. Ferrantini, J. Lotti, R. Coppini, P. Yan, L. M. Loew, C. Tesi, E. Cerbai, C. Poggesi, F. S. Pavone, Action potential propagation in transverse-axial tubular system is impaired in heart failure, **Proc Natl Acad Sci U S A** vol. 109 pp. 5815–5819 (2012).
9. V. Nucciotti\*, C. Stringari\*, L. Sacconi\*, F. Vanzi\*, L. Fusi, M. Linari, G. Piazzesi, V. Lombardi and F. S. Pavone, Probing myosin structural conformation in vivo by second-harmonic generation microscopy, **Proc Natl Acad Sci U S A** vol. 107 pp. 7763-8 (2010). (\* Equally contributing authors)
10. L. Sacconi, D. A. Dombeck, and W. W. Webb, Overcoming photodamage in second-harmonic generation microscopy: Real-time optical recording of neuronal action potentials, **Proc Natl Acad Sci U S A** vol. 103 pp. 3124-9 (2006).