



PERSONAL INFORMATION **Andrea Spanu**

 Istituto Universitario di Studi Superiori IUSS, Piazza della Vittoria, 27100 Pavia, PV

  +393290172712

 andrea.spanu@iusspavia.it

 Scopus Author's ID 55801736500

Sex M | Date of birth 14/03/1985 | Nationality Italian

Current Position: Assistant Professor (RTDB) ING-INF/06

Scientific Profile:

Andrea Spanu is a bioengineer expert in the design of innovative devices for cellular interfacing and organic transistors-based sensors, as well as the development of epidermal and textiles electrodes for biopotential detection. During his PhD experience he developed a device called Micro OCMFET Array, a tool based on the Organic Charge Modulated Field Effect Transistor (OCMFET – an ultra-sensitive and versatile organic charge sensor) specifically designed for cellular interfacing. During the postdoc experience (partially spent at the IBM Almaden Research Center, San Jose, California, and at the Bruno Kessler Foundation, Trento, Italy) he further expanded his expertise on cellular interfacing with the development of innovative devices with tridimensional recording sites for the in vitro monitoring of 3D cellular structures. He also has expertise in the field of chemical and physical sensing, biosensing, wearable and tattoo electronics, with a particular focus on the detection of biosignals for biomedical applications. He holds two courses, namely Biosensors at University of Cagliari (third year of the Biomedical Engineering program, 50 h, 5 CFU) and Biomedical sensors at the PhD program “The Hadron Academy” (20 h). He is author of 2 patents and more than 30 publications in highly ranked journals, conference proceedings and books.

GOLDEN PARAGRAPH**Bibliometric Indicators (scopus):**

Publications: 35; # Publications in Journals: 21; # Citations : 675; H index : 12; H Index (5 y) : 12.

WORK EXPERIENCE**Oct 2022 – Current**

Assistant Professor (RTDB) Istituto Universitario di Studi Superiori IUSS.

Main duties/responsibilities: Development of biomedical and wearable sensors based on organic transistors; development of innovative electrodes for wearable and tattoo electronics; Co-founder of the FLExible bioelectronics and Wearable devices laboratory (FLOW Lab); Professor of the course “Biomedical sensors”, PhD program “The Hadron Academy”

Sector: Research sector

Feb 2019 – Oct 2022

Assistant Professor (RTDA) University of Cagliari, Department of Electrical and Electronic Engineering

Main duties/responsibilities: Development of biomedical sensors based on organic transistors; development of innovative electrodes for wearable and tattoo electronics;

Professor of the course "Biosensors", third year of the Biomedical Engineering Program;
Sector: Research sector

Gen 2018 - Gen2019

Researcher (winner of a CARITRO grant for young researchers) at Bruno Kessler Foundation, Trento, ITALY

Main duties/responsibilities: Development of an organic transistor-based micro electrode array with tridimensional recording sites for brain-on-a-dish applications

Sector: Research sector

2015-2017

Post Doc, University of Cagliari, Department of Electrical and Electronic Engineering, Cagliari, ITALY

Main duties/responsibilities: Development of flexible sensors based on organic transistors for cellular interfacing and biosensing

Sector: Research sector

January - May 2016

Visiting scientist at IBM Almaden Research Center (Nanoscale Fabrication Group), San Jose, CA, US

Main duties/responsibilities: Development of a clean room process for the fabrication of a flexible, organic transistor-base device for in vitro cellular interfacing. Design, development and fabrication of a microelectrode array with tridimensional recording sites for in vitro organoids applications.

Sector: Research sector

January - April 2017

Visiting scientist at IBM Almaden Research Center (Nanoscale Fabrication Group), San Jose, CA, US

Main duties/responsibilities: Development of a clean room process for the fabrication of a flexible, organic transistor-base device for in vitro cellular interfacing. Design, development and fabrication of a microelectrode array with tridimensional recording sites for in vitro organoids applications.

Sector: Research sector

EDUCATION AND TRAINING

2012-2015

PhD in Bioengineering
University of Genova, ITALY
Organic devices for in vitro applications

Oct 2011

Master Degree in Bioengineering
University of Genova, ITALY

Apr 2008

Bachelor Degree in Biomedical Engineering
University of Cagliari, ITALY

TEACHING ACTIVITY

2022-now: **Holder of the course “Biomedical Sensors”** (PhD program “THE HADRON ACADEMY: RISK AND COMPLEXITY IN HIGH TECH MEDICAL INNOVATION”, - <https://iusspavia.coursecatalogue.cineca.it/insegnamenti/2022/1702/2022/9999/10060?course=2022>)

2019-now: **Holder of the course “Biosensors”** for the students of the bachelor's degree on Biomedical Engineering (University of Cagliari)

2017-2018 – **Teaching assistant of the course “Biosensors”** for the students of the bachelor's degree on Biomedical Engineering (University of Cagliari).

2013-2015 - **Teaching assistant of the course “Introduction to laboratory instrumentation”**, for the students of the master's degree on Bioengineering (University of Genova).

2007-2008 - **Teaching assistant of the course “Electronic devices”** for the students of the bachelor's degree on Biomedical Engineering (University of Cagliari).

PERSONAL SKILLS

Organisational / managerial skills

- Leadership (responsible of the activity of more than 20 undergraduate students in the past 5 years, main tutor of four PhD students and co-tutor of two PhD students)
- Laboratory management (Co-founder of the FLExible bioelectronics and Wearable devices laboratory - FLOW Lab)
- Clean room experience (IBM Almaden Research Center, San Jose, California, US – 9 months; Bruno Kessler Foundation, Trento, ITALY – 12 months)

ADDITIONAL INFORMATION

List of publications

1. A. Spanu, M. Taki, G. Baldazzi, A. Mascia, R. Pietrabissa, D. Pani, P. Cosseddu, A. Bonfiglio, Spray-coated, magnetically connectable free-standing epidermal electrodes for high quality biopotential recordings, *Advanced Engineering Materials*, <https://doi.org/10.1002/adem.202302195>.
2. A. Mascia, A. Spanu, A. Bonfiglio, P. Cosseddu, P. (2023), “Multimodal force and temperature tactile sensor based on a short-channel organic transistor with high sensitivity”, *Scientific Reports*, 13(1)
3. A. Mascia, R. Collu, A. Spanu, M. Frascini, M. Barbaro, P. Cosseddu (2023), “Wearable System Based on Ultra-Thin Parylene C Tattoo Electrodes for EEG Recording”, *Sensors*, 23(2), 766.
4. A. Mascia, A. Spanu, A. Bonfiglio, P. Cosseddu, P. (2023), “Multimodal force and temperature tactile sensor based on a short-channel organic transistor with high sensitivity”, *Scientific Reports*, 13(1), 16232.
5. Collu, Riccardo, et al. "A wearable electronic system for EEG recording." *2022 17th Conference on Ph. D Research in Microelectronics and Electronics (PRIME)*. IEEE, 2022.
6. Spanu, A., Martines, L., Tedesco, M., Martinoia, S., Bonfiglio, A., Simultaneous recording of electrical and metabolic activity of cardiac cells in vitro using an Organic Charge Modulated FET array, (2022) *Front. Bioeng. Biotechnol.* doi: 10.3389/fbioe.2022.945575
7. Spanu, A., Losi, T., Mascia, A., Bonfiglio, A., Caironi, M., & Cosseddu, P. (2022). Submicrometer-Channel Organic Transistors with MHz Operation Range on Flexible Substrates by a Low-Resolution Fabrication Technique. *Advanced Materials Technologies*, 2200891.
8. Spanu, A., Taki, M., Baldazzi, G., Mascia, A., Cosseddu, P., Pani, D., Bonfiglio, A. Epidermal Electrodes with Ferrimagnetic/Conductive Properties for Biopotential Recordings. *Bioengineering*, 9(5), 205, DOI: 10.3390/bioengineering9050205, (2022)

9. A. Spanu, Mascia, A., Baldazzi, G., Salerno, B. F., Torrisi, F., Viola, G., ... & Pani, D. Parylene C-based, breathable tattoo electrodes for high-quality biopotential measurements. *Frontiers in Bioengineering and Biotechnology*, 355, DOI: 10.3389/fbioe.2022.820217, (2022).
10. A. Spanu, L. Martines, A. Bonfiglio, Interfacing cells with organic transistors: a review of in vitro and in vivo applications, *Lab on a Chip*, 21.5:795-820, (2021).
11. F. Torricelli, D. Z. Adrahtas, Z. Bao, M. Berggren, F. Biscarini, A. Bonfiglio, ... A. Spanu, L. Torsi, Electrolyte-gated transistors for enhanced performance bioelectronics, *Nature Reviews Methods Primers*, 1(1), 1-24, (2021).
12. A. Spanu, A. Bonfiglio, In Vitro Multiparametric Cellular Analysis by Micro Organic Charge-modulated Field-effect Transistor Arrays, *Journal of Visualized Experiments: Jove*, 175, (2021).
13. A. Spanu, A. Botter, A. Zedda, G. L. Cerone, A. Bonfiglio, D. Pani, Dynamic surface electromyography using stretchable screen-printed textile electrodes, *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 29, 1661-1668, (2021).
14. Spanu, A., Lorenzelli, L., Bozano, L., Martinoia, S., & Bonfiglio, A. (2021). Organic Devices and Brain Organoids: The Quest for Next Generation Neuronal Interfacing. In 2021 10th International IEEE/EMBS Conference on Neural Engineering (NER).
15. Baldazzi, G., Spanu, A., Mascia, A., Viola, G., Bonfiglio, A., Cosseddu, P., & Pani, D. (2021). Validation of a Novel Tattoo Electrode for ECG Monitoring. In 2021 Computing in Cardiology (CinC) (Vol. 48, pp. 1-4). IEEE
16. A. Spanu, N. Colistra, P. Farisello, A. Friz, N. Arellano, C. T. Rettner, A. Bonfiglio, L. Bozano, S. Martinoia, "A three-dimensional micro-electrode array for in-vitro neuronal interfacing." *Journal of Neural Engineering*, 17(3). DOI: <https://doi.org/10.1088/1741-2552/ab9844>, (2020).
17. Martinoia, S., Andolfi, A., Muzzi, L., Pisano, M., Spanu, A., & Raiteri, R. (2020, December). Neuro-electronic devices and nanotools to interact with neuronal networks. In 2020 IEEE International Electron Devices Meeting (IEDM) (pp. 14-1). IEEE.
18. M. B. Lodi, N. Curreli, A. Fanti, C. Cuccu, D. Pani, A. Sanginario, A. Spanu, P. Motto Ros, M. Crepaldi, D. Demarchi, G. Mazzarella, A Periodic Transmission Line Model for Body Channel Communication. *IEEE Access*, pp. 160099 - 160115. DOI:10.1109/ACCESS.2020.3019968, (2020).
19. Pani, D., Achilli, A., Spanu, A., Bonfiglio, A., Gazzoni, M., & Botter, A. Validation of polymer-based screen-printed textile electrodes for surface EMG detection. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, (2019).
20. T. G. Pattison, A. Spanu, A. M. Friz, Q. Fu, R. D. Miller, G. G. Qiao, "Growing Patterned, Cross-linked Nanoscale Polymer Films from Organic and Inorganic Surfaces Using Ring-Opening Metathesis Polymerization." *ACS Applied Materials & Interfaces*, 12.3:4041-4051, (2019).
21. Lorenzelli, L., Spanu, A., Pedrotti, S., Tedesco, M., & Martinoia, S. (2019, June). Three-Dimensional Microelectrodes Array Based on Vertically Stacked Beads For Mapping Neurons' Electrophysiological Activity. In 2019 20th International Conference on Solid-State Sensors, Actuators and Microsystems & Eurosensors XXXIII, pp. 987-990, IEEE.
22. F. Viola, A. Spanu, P. C. Ricci, A. Bonfiglio, P. Cosseddu, "Ultrathin, flexible and multimodal tactile sensors based on organic field-effect transistors", *Scientific Reports*, , 8, 8073 doi:10.1038/s41598-018-26263-1 (2018).
23. A. Spanu, M. Tedesco, L. Martines, S. Martinoia, and A. Bonfiglio, "An organic neurophysiological tool for neuronal metabolic activity monitoring". *APL Bioengineering*, 2(4), 046105 (2018).
24. A. Spanu, F. Viola, S. Lai, P. Cosseddu, P. C. Ricci, A. Bonfiglio, "A reference-less pH sensor based on an organic field effect transistor with tunable sensitivity". *Organic Electronics* 48, 188–193, doi.org/10.1016/j.orgel.2017.06.010 (2017).
25. A. Spanu, L. Pinna, F. Viola, L. Seminara, M. Valle, A. Bonfiglio, P. Cosseddu, "A high-sensitivity tactile sensor based on piezoelectric polymer PVDF coupled to an ultra-low voltage organic transistor", *Organic Electronics*, 36, 57-60, doi.org/10.1016/j.orgel.2016.05.034, (2016).

26. A. Spanu, S. Lai, P. Cosseddu, M. Tedesco, S. Martinoia, A. Bonfiglio, "An organic transistor-based system for reference-less electrophysiological monitoring of excitable cells", Scientific Reports, , doi:10.1038/srep08807, (2015).
27. A. Spanu, S. Lai, P. Cosseddu, M. Tedesco, A. Bonfiglio, S. Martinoia, "Bioelectrical and metabolic activity recordings by means of organic field effect transistors", AISEM Proceedings, doi:10.1109/AISEM.2015.7066781, 2015.
28. M. Demelas, S. Lai, A. Spanu, S. Martinoia, P. Cosseddu, M. Barbaro, A. Bonfiglio "Charge sensing by Organic Charge-Modulated Field Effect Transistors: application to the detection of bio-related effects", Journal of Material Chemistry B, doi:10.1039/c3tb20237b, (2013).
29. A. Spanu, S. Lai, P. Cosseddu, A. Bonfiglio, M. Tedesco, S. Martinoia, Member, IEEE, "Organic FET device as a novel sensor for cell bioelectrical and metabolic activity recordings", IEEE NER, doi:10.1109/NER.2013.6696089, 2013.

Projects/Grants

- Project: ANALYSER - AN orgANic muLti-functional sYStem for the bioelectrochemical characterization of cellular assEmblies in vitRo, Italian Project PRIN PNRR 2022.
Role: Principal Investigator
- Project: POC project ORGANOI^{3D} - ORGAnic charge modulated fet-based system for Optimized In vitro 3D electrophysiology (<https://unige.it/ricerca/organoi3d-organic-charge-modulated-fet-based-system-optimized-vitro-3d-electrophysiology>).
Role: responsible for the experimental part
- Project: PON TEX-STYLE ARS01_00996 (Nuovi tessuti intelligenti e sostenibili multi-settoriali per design creativo e stile made-in-Italy, PNR 2015-2020)
Role: responsible for the experimental part
- Project: European project Search&Rescue (Emerging technologies for the Early location of Entrapped victims under Collapsed Structures and Advanced Wearables for risk assessment and First Responders Safety in SAR operations; programma: H2020-EU.3.7.5. - Increase Europe's resilience to crises and disasters. Argomento: SU-DRS02-2018-2019-2020 - Technologies for first responders)
Role: responsible for the experimental part

Patents

- A. Spanu, M. Tedesco, A. Bonfiglio, L. Stefano, S. Martinoia, S., P. Cosseddu, P., "Organic Transistor-based system for electrophysiological monitoring of cells and method for the monitoring of the cells PCT/EP2016/052433 (priority date: 04.02.16).
- A. Spanu, A. Bonfiglio, S. Lai, P. Cosseddu, D. Pani, "Method for manufacturing an ultra-thin epidermal sensor and sensor obtained", WO2021074664A1, 14.10.19

Conferences

Session Chair

Symposium: "Fundamentals of Organic Bioelectronic Devices",
Conference: NanoGE Spring Meeting 2022 (virtual conference)

Symposium Chair

Symposium : "Organic Materials and Devices for Electronic Neural Interfaces: Novel Ideas for in Vitro and in Vivo Applications"
Conference: 10th International IEEE/EMBS Conference on Neural Engineering (NER) 2021 (virtual conference)

Organizing Committee Member

Conference: ORBITALY (Organic Bioelectronics Italy) 2017

Invited contribution

Contribution title: "Interfacing imperceptible electronics with the human body: new solutions and approaches"

Conference: Materials Research Society Fall Meeting, Boston, US, Nov 30th 2022

Oral contribution

Contribution title: "Multifunctional, organic transistor-based platforms for the in vitro interfacing of 2D and 3D cellular cultures"

Conference: ORBITALY (Organic Bioelectronics Italy) 2020, Erice (TP) 3-9 Jul 2022

Oral contribution

Contribution title: "Organic semiconductor-based systems for the simultaneous recording of the electrical and metabolic activity of in vitro cellular aggregates"

Conference: NanoGE Spring Meeting 7th-11th March (virtual conference)

Oral contribution

Contribution title: "Validation of A Novel Tattoo Electrode for ECG Monitoring"

Conference: Computing in Cardiology 2021 (virtual conference)

Oral contribution

Contribution title: "Organic Devices and Brain Organoids: The Quest for Next Generation Neuronal Interfacing"

Conference: 10th International IEEE/EMBS Conference on Neural Engineering (NER) 2021 (virtual conference)

Oral contribution

Contribution title: "Stretchable screen-printed PEDOT:PSS electrodes for upper arm surface electromyography"

Conference: 42nd Annual International Conferences of the IEEE Engineering in Medicine and Biology Society 2020 (virtual conference)

Oral contribution

Contribution title: "Tattoo-Like Electronic Systems for on Body Measurements"

Conference: Materials Research Society Spring Meeting, Phoenix, US, 2019

Oral contribution

Contribution title: "An OCMFET-based platform for electrical and metabolic activity monitoring of living cells in vitro"

Conference: Sixth National Congress of Bioengineering, Milan, ITALY, 2018

Oral contribution

Contribution title: "Monitoring the electrical and metabolic activity of living cells by means of flexible organic devices"

Conference: Materials Research Society Fall Meeting, Boston, US, 2017

Oral contribution

Contribution title: "Flexible Multimodal Sensing Devices Based on Charge Modulated OTFTs for Tactile Applications"

Conference: Materials Research Society Fall Meeting, Boston, US, 2014

Oral contribution

Contribution title: "In-vitro Recordings Of Electrogenic Cells Activity With Organic Field Effect Transistors"

Conference: 9th International Meeting on Substrate-Integrated Micro Electrode Array, Reutlingen, Germany, 2014

Honours and awards**2016**

"Springer Theses Award" and publication of the PhD theses in the Springer Theses book series (<https://link.springer.com/book/10.1007/978-3-319-28880-2>)

2015

"Massimo Grattarola PhD award", XXXIV School of the Bioengineering National Group (GNB)

2012

"Best Thesis award", XXXI School of the Bioengineering National Group (GNB)

According to law 679/2016 of the Regulation of the European Parliament of 27th April 2016, I hereby express my consent to process and use my data provided in this CV

Pavia, 12/04/2024
Signature