B·DEBATE International Center for Scientific Debate BARCELONA

IDIBAPS Institut D'Investigacions Biomèdiques August Pi i Sunyer

GUGLIELMO FORTUNATO

CV

PARTICIPANT AT:

A DIALOGUE WITH THE CEREBRAL CORTEX:
CORTICAL FUNCTION AND INTERFACING

April, 29th-30th, 2015, Barcelona

Guglielmo Fortunato, Acting Director of the **Institute for Microelectronics and Microsystems** of the **Italian National Research Council** (IMM-CNR), Rome, Italy

Guglielmo Fortunato is research director at IMM-CNR Roma Unit, where he leads the Devices for Large Area Electronics Group. His main scientific activity is on the physics and technology of inorganic (amorphous, micro- and polycrystalline silicon) and organic thin film transistors (TFTs). He has given a substantial contribution to the physics of polysilicon TFTs and has pioneered the use of excimer laser annealing for polysilicon TFTs and ultra-shallow junction formation. Recently he focused on low temperature process for flexible electronics, including sensor applications and microelectrode arrays for brain signal recording. He has been responsible of several National and European Research projects and also of industrial research contracts with ST-Microelectronics, Philips and THALES. He has authored more than 220 papers published on ISI-indexed journals, more than 140 contributions to International Conferences, 35 invited talks in International Conferences and is author of 5 invited chapters on books and holds 10 patents.

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GUGLIELMO FORTUNATO ABSTRACT

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Ultra-flexible Microelectrode Arrays with Integrated Control Electronics for Electrophysiology Applications

Electrocorticography (ECoG), thanks to its low degree of invasiveness, has received in recent years an increasing attention for chronic brain-machine interface (BMI) applications. High-resolution microelectrode arrays (MEAs) are of interest for both current clinical applications, providing access to more precise neural activity localization, and novel applications, such as neural prosthetics. Developing such MEAs is not trivial because their small contact area increases the electrode impedance, which seriously affects the signal-to-noise ratio, and adhering such an electrode to the brain surface becomes critical. The most straightforward approach requires increasing the array conformability with flexible substrates while improving the electrode performance. In this work, we present a process to fabricate ultra-flexible and conformable polyimide-based MEAs of sub-millimeter recording sites. The MEAs have been integrated with a digital electrophysiology interface, able to filter and amplify 32 analog channels and specifically designed to match the impedance of a passive MEAs. Moreover, the board was equipped with independent stimulation channels that allow to locally stimulate through two independent output channels by means of AC or DC voltage and currents applied by an external source. In this way, it is possible simultaneously to stimulate during the recordings in order to investigate and develop closed loop control algorithms. In addition, the board is equipped with a microcontroller, that has the main advantage of integrating USB communication directly on the board and manages also other peripherals. The NeuroDaq smart system has been successfully validated with in-vivo tests performed at IDIBAPS and Local field Potential (LFP) from the left motor-somatosensory cortex of Wistar male rat were recorded.

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