

Three-Dimensional Nanostructures for Bio-Photonics and Neural Engineering

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In the last years we introduced different 3D nanostructures and devices for managing the electromagnetic field at the nanoscales through the generation of surface plasmons polaritons. Firstly, we will briefly revise our past achievements concerning 3D plasmonic nanostructures and their applications to bio-sensing. Secondly, we will show our recent achievements and future perspectives of plasmonic nanopores for next generation sequencing of DNA and protein (European Project FET-Open “Proseqo”, GA N°687089). In the final part we will present the exploitation of 3D nano-devices in combination with CMOS arrays for intracellular recording of action potentials in mammalian neurons and intracellular delivery of biomolecules, genetic materials and nanoparticles. Also, the active interaction of the cell membrane with such 3D devices will be discussed. The developed platform may enable significant advances in the investigation of the neuronal code, development of artificial retinas and low-cost in-vitro platforms devoted to the pharmacological screening of drugs for the central nervous system. As future perspective we will also discuss potential application of our system for the investigation of electrical activities of plant roots that in the near future may revolutionize plant biology. This project is supported by the European Community through the IDEAS grant program

(“Neuroplasmonics”, GA N° 616213).

Biography:

Francesco De Angelis is currently Senior Scientist at the Italian Institute of Technology and Supervisor of Nanostructure Facility (clean room). He leads the Plasmon technology Unit (about 25 members) and his main expertise relies on micro and nano-optical devices for biomedical applications. He currently holds an IDEAS-ERC Consolidator grant whose aim is to develop radically new interfaces between electrical/optical devices and neuronal networks. He published more than 100 papers on peer-review impacted journals; total impact factor > 700; H index = 36, citation=5000.