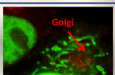
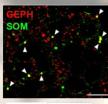
CNR NEUROSCIENCE INSTITUTE - PISA

Pathological conditions of the CNS: from molecules to humans. Contribution of imaging

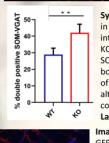
The BioEnable Platform



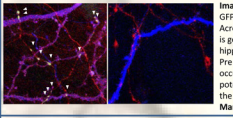


Imaging organelles: Golgi complex is stained with lectins and mitochondria are labeled by a GFP-FoxG1 construct.
Mario Costa, IN-CNR
Laura Colombaioni, IN-CNR

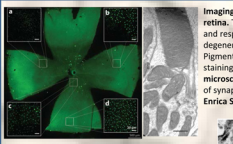
Subcellular compartments of living neurons are studied in healthy conditions or in disease models by confocal microscopy. **Mitochondrial physiology and dynamics** are monitored through high definition imaging with genetically-encoded or fluorescent probes.
Laura Colombaioni, IN-CNR



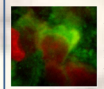
Synaptic contact functionality in a mouse model of X-linked intellectual disability (OPHN1-KO). A significant increase of SOM-VGAT double positive boutons in the hippocampus of KO animals indicates specific alterations in their neuronal connectivity.
Laura Restani, IN-CNR



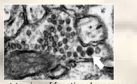
Imaging synaptic potentiation: GFP fragment Reconstitution Across Synaptic Partners (GRASP) is genetically expressed in hippocampal neurons.
Pre and postsynaptic connections occurring specifically at potentiated synapses light up in the confocal microscope.
Marco Mainardi, IN-CNR



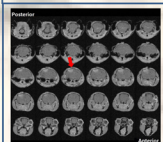
Imaging genetic diseases of the retina. The architecture, survival rate and response to treatments of degenerating neurons in Retinitis Pigmentosa are studied by antibody staining , **quantitative confocal microscopy and electron microscopy** of synaptic circuitry.
Enrica Strettoi, IN-CNR



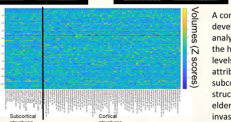
Targeting acetylcholine receptors in glaucoma : the green signal highlights a retinal ganglion cells labelled with a **fluorescent toxin** that binds a specific subunit of acetylcholine (nicotinic) receptors.
Nicola Origlia, IN-CNR



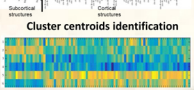
Tract-tracing of functional synapses with FM143 followed by **photoconversion** and EM imaging reveals individual, recycled vesicles travelling to their final destination in the synaptic endings.
Eleonora Vannini, IN-CNR



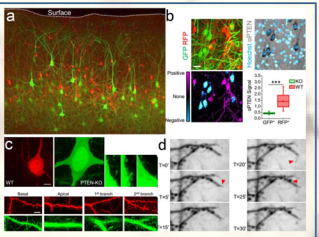
Magnetic resonance imaging of the mouse brain provides high resolution representation of all areas in normal and pathological conditions and it is exploited here to reveal a brain glioma.
Eleonora Vannini, IN-CNR
Mario Costa, IN-CNR



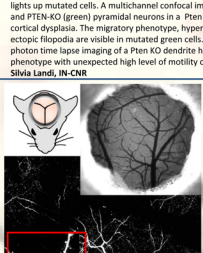
Cluster centroids identification



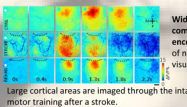
A complex, custom-developed data driven analysis of **MRI images** of the human brain identifies levels of atrophy clearly attributable to specific subcortical or cortical structures of the brain of elderly people. This non-invasive method of imaging and patient clusterization could have powerful applications for the diagnosis of various brain disorders.
Alessandro Sale, IN-CNR



Structural modifications of single cells revealed with Beatrix, a dual-color reporter system that, when transduced in a floxed mouse line for a target gene, lights up mutated cells. A multichannel confocal image shows wild-type (red) and PTEN-KO (green) pyramidal neurons in a Pten floxed mouse, a model of cortical dysplasia. The migratory phenotype, hypertrophy and presence of ectopic filopodia are visible in mutated green cells. Panel d shows in vivo, two-photon time lapse imaging of a Pten KO dendrite highlighting the immature phenotype with unexpected high level of motility of terminals.
Silvia Landi, IN-CNR

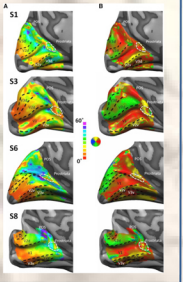


Fluorescence imaging through a chronic cranial window allows the visualization of GFP-expressing neurons with **two-photon microscopy**. Blood vessels can be used as a reference grid. The fine structure of individual neurons (on the right) and dynamics of single, dendritic spines (red box) can be followed in time, thus revealing disease-associated abnormalities, as in the case of Rett Syndrome and CDKL5 Deficiency Disorder.
Elena Putignano, IN-CNR
Laura Baroncelli, IN-CNR



Wide-field calcium imaging combined with genetically encoded fluorescent reporters of neuronal activity allow visualization of cortical remapping.

Large cortical areas are imaged through the intact skull during rehabilitative motor training after a stroke.
Letizia Allegra Mascaro, IN-CNR



Novel fMRI protocol reveals new brain functions in the occipital cortex.
fMRI imaging obtained through an innovative optic fiber stimulation delivered directly inside the scanner. In the left lane, red areas are selective for the retinal fovea; blue zones correspond to visual periphery. The methods has revealed unknown selectivity to visual motion of the prostriate area of the brain. In previously used protocols, these areas would have appeared as «silent».
Guido Marco Cicchini, IN-CNR

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