



SynActive toolbox

Scuola Normale Superiore (Pisa) and EBRI (Roma)

 The only molecular tool for studying memory at a single-synapse resolution

TECHNOLOGY DESCRIPTION

We realized a new molecular toolbox, dubbed "SynActive" for labeling and manipulating potentiated synapses recruited by learning and memory.

Prior to the development of our solution, the study of the physical substrates of memory (engrams) was limited to a whole-neuron spatial resolution.

SynActive is a versatile, genetically encoded toolbox, for expression of any protein of interest specifically at synapses that have been potentiated as a result of learning and memory.

Our system can be tailored to a wide range of experimental approaches, from imaging, to synapse control, to proteomic fingerprinting of potentiated synapses.

SynActive allows investigating the synaptic basis of memory with unprecedented precision and spatial resolution, in physiology and pathology (e.g., Alzheimer's disease).

A genetically encoded tool for identification of the physical substrates of memory at the synaptic microscale, allowing high-output data for computational modelling of the brain circuitry responsible for memory maintenance.

Adaptable to a wide range of experimental needs (imaging, functional studies, molecular fingerprinting) to define the properties of synapses serving memory in physiology and neurodegenerative diseases.

AREAS

Microscale imaging | Single-synapse studies | Physiology of memory | Diseases of memory & neurodegeneration





COMPETITIVE ADVANTAGES

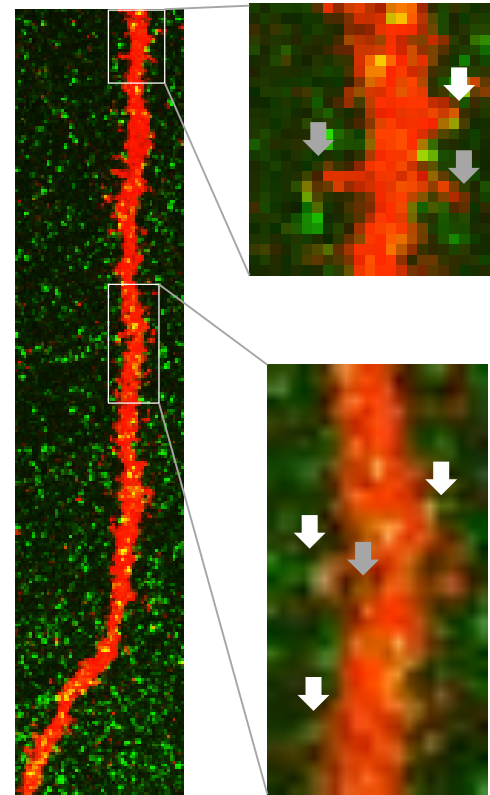
- The only platform currently available to genetically tag and manipulate synapses serving memory (synaptic engrams)
- SYNACTIVE drives the activity-regulated expression of synaptic reporters only at potentiated synapses
- Cartography of the SYNAPTIC ENGRAM, i.e. the subset of potentiated synaptic assemblies recruited by memory
- Molecular profiling of the proteome of potentiated synapses
- Versatile: based on genetically encoded protein constructs, it can be applied to study any brain structure

SynActive is the only platform allowing a comprehensive translational study of synaptic engrams

APPLICATION & MARKET POTENTIAL

- A game-changing platform for translational research on the synaptic basis of memory in physiology and memory pathologies.
- Target users of SYNACTIVE are neuroscientists, computational scientists, pharmaceutical industry:
- Identifies new druggable targets for learning and memory disorders by selective proteomics of potentiated synapses.
- Delivers unique data necessary for computational models of learning and memory.

Cartography of synaptic memory engrams using SynActive. *Left*, low-magnification view of a dendrite section from the hippocampus CA1 area. *Right*, zooms corresponding to the boxed areas in the left panel. Labeling of the entire dendrite, including its dendritic spines (white arrowheads) is achieved via constitutive expression of TdTomato fluorescent protein, whereas SynActive-driven expression of Venus fluorescent protein selectively labels potentiated dendritic spines (gray arrowheads), involved in synaptic engram formation.



TECHNOLOGY READINESS LEVEL



REFERENCES

The implementation of SYNACTIVE is facilitated by a growing toolbox of viral vectors, that are being distributed to the scientific community. SYNACTIVE requires standard, average-lab resources for implementation. SNS and EBRI are institution research centers of excellence in Neuroscience.

CONTACT

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