# First fMRI images of individual neurons

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A research team from CEA NeuroSpin and the Institut de neurosciences cognitives et intégratives d'Aquitaine (CNRS/Université de Bordeaux) demonstrated the possibility to obtain functional magnetic resonance images (fMRI) with single cell resolution. These results have been published in *PNAS*.

The researchers studied the Aplysia californica, a marine gastropod mollusk commonly known as "sea hare", whose nervous system is composed of a small number of neurons (20 000). They obtained images of the majority of neurons within the buccal ganglia of the animal using an ultra-high magnetic field MRI system (17.2 T).

The technique implemented relied on injecting into the living animal small quantities (non-toxic doses) of a contrast agent, manganese, which enters and accumulates within active neurons. Maps of the manganese distribution within the buccal network were subsequently obtained revealing the neurons activated by different food stimuli.

The presence of an aliment in the animal's environment and its ingestion lead to different neuronal responses in the same neurons. Therefore, this microscopic fMRI technique can be used to probe the functional organization and plasticity of neuronal networks with single cell resolution

Applying this method to studying the entire nervous system of the Aplysia will allow, in the near future, investigations of functional alteration leading to neurological damage. Using the same approach to investigate vertebrate nervous systems is challenging but certainly not impossible. Magnetic resonance microscopy images of chemically fixed human and porcine neurons have been obtained at lower magnetic field strengths. It is conceivable that the method published in *PNAS* coupled with improved hardware technologies (microcoils, stronger magnetic field gradients) will allow single-cell functional magnetic resonance studies of live mammalian tissues.

**More information:** Paper: Functional magnetic resonance microscopy at single-cell resolution in Aplysia californica, Guillaume Radecki, DOI: 10.1073/pnas.1403739111

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