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Brain works like a radio receiver

Date: January 22, 2014

Source: Radboud University Nijmegen

Summary: Initial evidence is found that the brain has a 'tuning knob' that is actually influencing behavior. Brain circuits can tune into the frequency of other brain parts relevant at the time.

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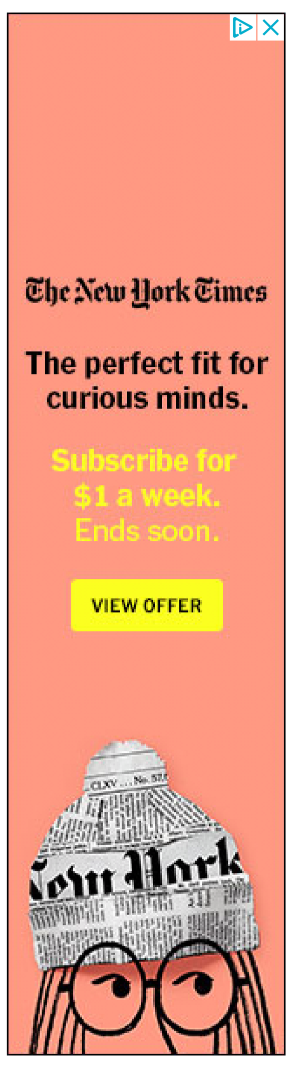

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FULL STORY

Initial evidence is found that the brain has a 'tuning knob' that is actually influencing behavior. Brain circuits can tune into the frequency of other brain parts relevant at the time. The scientific magazine *Neuron* is publishing the results of researchers at Radboud University the Netherlands on January 22.

Animals (and humans alike) have a metal map of the surrounding environment, consisting of place cells. These cells correspond with places in the physical space and fire when the animal reaches the place or remembers it. The mental map is fed by two sorts of information: with memories from earlier experiences, and with sensory information. But how does the mental map upload this information?

Direct measurements in the brain of mice, looking for their way in a maze, show that memory information is sent with another frequency to the mental map than sensory information is. The brain area representing the mental map synchronizes with these frequencies like a radio receiver: it is only tuning into the information that is important at a given time, an international team of researchers led by Francesco Battaglia from the Donders Institute for Brain, Cognition and Behaviour at Radboud University Nijmegen show. This research sheds light on the intriguing question how brain parts choose relevant information from the constant scattering of neurons going on in the brain.

Information transfer within the brain

Using implants in the brains of mice, the neuroscientists have found the first direct proof of the way the brain tuning knob works. The tiny implanted electrodes can collect and send information about individual brain cells at work. Because the devices -- that weigh only two grams and don't seem to bother the free roaming rodents -- measure several cells at a time, the network activity can be followed as well, Francesco Battaglia explains.

Micro wire-tapping

The researchers used a maze in the shape of the Pentagon, with five corridors in which a treat was hidden or not. The mice were trained to do their search for the reward from a fixed starting point and started to take the shortest route to the treat quite routinely. To test how the animals are able to navigate to the goal, researchers challenge them by starting them, every once in a while, from a different maze arm than they are used to. Then, mice headed to the usual location of the treat, probably using landmarks to orientate, but other times they just relied on the memorized sequence of left and right turns and ended up in the wrong maze arm.

Data analysis challenge

Meticulous analyses of the brain data revealed that when the mice used their memory the place field cells oscillated in the same frequency as the memory cells (at 35 Hz), but tuned into the vibe of the sensory cells when they appeared to be using landmarks (60 Hz).

To further clarify the different roles of memory and sensory input to the mental map, the researchers repeated the experiment with knock out mice in which the gene coding for the NMDA-receptor was blocked. Battaglia says: 'We know NMDA is important for well functioning synapses, and for oscillations. To our surprise, the knock out mice weren't able to send information from their sensory system to the mental map at all.'

Story Source:

Materials provided by **Radboud University Nijmegen**. *Note: Content may be edited for style and length.*

Journal Reference:

1. Cabral et al. **Oscillatory dynamics and place field maps reflect sequence and place memory processing in hippocampal ensembles under NMDA receptor control**. *Neuron*, January 2014

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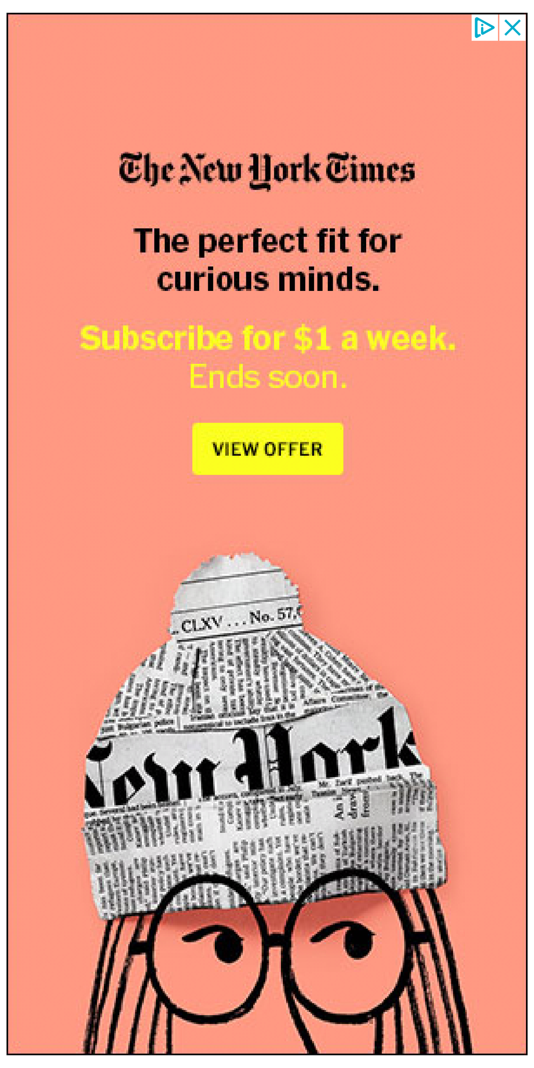

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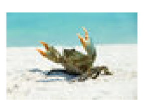

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