ELSC-ICNC Seminar: Inbal Goshen

March 14, 2013

On the topic of: "Illuminating behavior: An optogenetic approach to study the role of neurons and glia in normal behavior and neuropsychiatric disorders"

ELSC & ICNC cordially invite you
to the lecture given by:

Inbal Goshen
ELSC

On the topic of:

"Illuminating behavior: An optogenetic approach to study the role of neurons and glia in normal behavior and neuropsychiatric disorders"

The lecture will be held on Thursday, March 14, 2013
at 17:00, at ELSC-ICNC: Silverman Bldg., 3rd Wing, 6th Floor, Edmond J. Safra Campus

Light refreshments at 16:45

Abstract:

Prevailing theory suggests that contextual fear memories in rodents depend on the hippocampus over the recent timescale of days after training but are unaffected by hippocampal lesions or pharmacological inhibition on the remote timescale of weeks after training, presumably as the cortical memory trace becomes robust. However, using optogenetic methods (which are orders of magnitude faster in onset and offset than earlier methods), we showed that many weeks after contextual conditioning (far into the ?remote? phase), the recall of contextual fear memory could be abolished by optogenetic inhibition of excitatory neurons in the CA1 region - at times when earlier studies had found no detectable influence of hippocampus. This recall disruption is reversible, as when the same mice were re-introduced to the conditioning context on the next day with no illumination they demonstrated intact fear responses.
Furthermore, this optogenetic 'memory switch' could instantaneously suppress an ongoing contextual memory post-retrieval in the midst of a single freely-moving behavioral session. In exploring mechanism, we found that loss of hippocampal involvement at remote timepoints depended on the timescale of hippocampal inhibition, since extending optogenetic inhibition of the hippocampus to match typical pharmacological timescales converted the remote hippocampal-dependence to remote hippocampal-independence. We further confirmed using optogenetic inhibition, the remote-timescale importance of anterior cingulate cortex (ACC). Finally, in a whole-brain activity imaging study using c-fos labeling, we showed that the hippocampus is involved in the recruitment of the ACC for remote recall, as optogenetic inhibition of hippocampus during remote exposure to the context significantly reduced ACC activity. These findings uncover a remarkable dynamism in the mammalian memory retrieval process, in which underlying neural circuitry adaptively shifts the default structures involved in memory—normally depending upon the hippocampus even at remote timepoints, but flexibly moving to depend upon alternate mechanisms on the timescale of minutes. The involvement of glia cells in neuronal activity, normal behavior and neuropsychiatric disorders will also be discussed.
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