Memory experts show sleeping rats may have visual dreams

December 18 2006

Memories of our life stories may be reinforced while we sleep, MIT researchers report Dec. 17 in the advance online edition of *Nature Neuroscience*.

Matthew A. Wilson, professor of brain and cognitive sciences at MIT's Picower Institute for Learning and Memory, and postdoctoral associate Daoyun Ji looked at what happens in rats' brains when they dream about the mazes they ran while they were awake.

In a landmark 2001 study, Wilson showed that rats formed complex memories for sequences of events experienced while they were awake, and that these memories were replayed while they slept--perhaps reflecting the animal equivalent of dreaming.

Because these replayed memories were detected in the hippocampus, the memory center of the brain, the researchers were not able to determine whether they were accompanied by the type of sensory experience that we associate with dreams--in particular, the presence of visual imagery.

In the latest experiment, by recording brain activity simultaneously in the hippocampus and the visual cortex, Wilson and Ji demonstrated that replayed memories did, in fact, contain the visual images that were present during the running experience.

"This work brings us closer to an understanding of the nature of animal dreams and gives us important clues as to the role of sleep in processing

memories of our past experiences," Wilson said.

Reinforcing memories

By recording the spiking patterns of electrodes in individual neurons in the rats' brains, Wilson is able to compare the activity of the neurons when the animal is awake and asleep. It turns out that neurons activated when the animal experiences an event while awake are reactivated during sleep.

In addition, the region of the cortex that processes input from the senses and the hippocampus "talk" to each other during sleep, leading researchers to speculate that this process reinforces and consolidates memories.

But research to date lacked specific evidence that episodic memory--times, places and emotions related to events that make up our life stories--is reinforced in the cortex, the hippocampus or both during sleep.

For the first time, this work shows that the brain is replaying memory events in two locations at once--in the visual cortex and in the hippocampus.

"These results imply simultaneous reactivation of coherent memory traces in the cortex and hippocampus during sleep that may contribute to or reflect the result of the memory consolidation process," Wilson and Ji wrote.

Source: MIT