Chandelier cells unveil human cognition

September 3 2008

What is it that distinguishes humans from other mammals? The answer to this question lies in the neocortex – the part of the brain responsible for sensory perceptions, conscious thought, and language. Humans have a considerably larger neocortex than other mammals, making it an ideal subject for the research of higher cognition. In this month's issue of *PLoS Biology,* authors Tamas, et al, reveal new insights into the mysteries of neocortex organization and function.

Theories about cognition couldn't be more different. One theory suggests that humans have a higher cognition because we have larger cells and a more complex circuitry in the neocortex. Another theory claims that our higher cognition is due to different types of cells in the neocortex – cells that other mammals don't have. The authors, Tamas, et al, point to an important role in chandelier cells – so-named for their structural resemblance to an old-fashioned candlestick.

In this study, the authors study the microcircuitry of neocortical cells by recording from pairs of connected neurons in human brain tissue. This challenging method allowed them to measure the dynamic communication lines between neurons, illustrating how neurons interact and affect one another.

Whereas previously it was thought that neurons worked in groups to affect the brain, the authors show that a single chandelier cell can trigger multiple excitatory pyramidal cells – which make up the bulk of the cortex – and cause a chain reaction throughout the brain.

By triggering specific chandelier cells, the authors were able to elicit a precisely timed chain of electrical events in the neocortex. Additionally, the authors found that the synaptic pathways between chandeliers and pyramid cells are incredibly strong – much stronger than has been recorded previously in other mammals. This suggests that humans do possess different types of cells, and that our higher cognition isn't due to having larger cells.

Although chandelier cells have been found in other species, they are more complex in humans. This raises the possibility that there are many things which attribute to higher cognition – different types of cells, and a complex circuitry, perhaps. This study by Tamas, et al, furthers the search for the answers to higher cognition, and more fully opens the door to questions of how our brains compare to those of other species.

Citation: Molnár G, Oláh S, Komlósi G, Füle M, Szabadics J, et al. (2008) Complex events initiated by individual spikes in the human cerebral cortex. PLoS Biol 6(9): e222. doi:10.1371/journal.pbio.0060222
dx.plos.org/10.1371/journal.pbio.0060222

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