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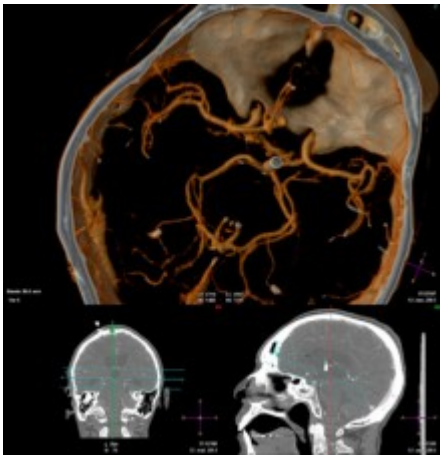
Study shows sleep enhances removal of potentially toxic brain debris

By ACSH Staff — October 21, 2013



[1]A new study published [2] in *Science* shows evidence that, in mice, substances like amyloid-beta known to be increased in Alzheimer s disease and others, are removed from the cerebrospinal fluid bathing the brain at an accelerated rate during sleep.

Scientists have long speculated that one of the functions of sleep is to restore and repair the brain. The current study, by a group of researchers from the University of Rochester Medical Center in New York, provides direct experimental evidence that the mouse brain cleans itself during sleep, by expanding channels between neurons (brain cells) that allow an influx of cerebrospinal fluid. The fluid flushes out detritus such as amyloid proteins, which accumulate as plaques in Alzheimer's disease, twice as fast when mice are sleeping as when they are awake.

Real-time imaging in live mice awake, sleeping normally, and under anesthesia showed that both the natural and artificially induced sleep states were associated with 60% increases in interstitial space [3] within the animals' brains, with large corresponding increases in convective exchange of cerebrospinal fluid (CSF) with interstitial fluid (the fluid that bathes brain cells, supplying nutrients and removing waste products).

According to *Science* correspondent Emily Underwood, The current publication illustrates work that builds on the lead author s discovery (Maikin Nedergaard is her name), described last summer [4]in Science Translational Medicine, of a network of microscopic, fluid-filled channels that clear toxins from the brain [4], much as the lymphatic system clears out metabolic waste products from the rest of the body. Instead of carrying lymph, this system transports waste-laden cerebrospinal fluid (CSF). Before the discovery of this glymphatic system, [5] as Nedergaard has dubbed it, the brain's only known method for disposing of cellular trash was to break down and recycle it within individual cells, she says.

ACSH s Dr. Gilbert Ross had this perspective on the new study: Although this is a mouse study,

the results echo previous work along the same lines, adding to its credibility. There is no reason to believe that the waste products of rodent brains and the removal of them is vastly different from our own mechanism, although such should not be assumed. It does not seem too farfetched to perform similar studies on humans to get corroboration. Still, the take-home message is one to listen to: get a good night s sleep, everyone! There are myriad studies documenting the benefits of 7-9 hours nightly, and many showing the adverse effects of chronic sleep deprivation. Whether the latter is linked with Alzheimer s remains to be seen."

Links

[1] http://acsh.org/wp-content/uploads/2013/10/cerebral-circulation.jpg
[2] http://www.sciencemag.org/content/342/6156/373.abstract
[3] http://www.medpagetoday.com/PrimaryCare/SleepDisorders/42365?xid=nl_mpt_DHE_2013-10-19&utm_content=&utm_medium=email&utm_campaign=DailyHeadlines&utm_source=WC&eu
[4] http://stm.sciencemag.org/content/4/147/147ra111
[5] http://news.sciencemag.org/brain-behavior/2013/10/sleep-ultimate-brainwasher