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PRESS RELEASE

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WHILE WE SLEEP OUR BRAINS STAY BUSY

- **Sleep boost intelligence in women but not in men**
- **Memory formation during disturbed in people with mental illness**

While we sleep, our brains stay busy, managing our memories and processing information. Scientists in Germany have recorded sleep spindles, electrical activity in the brain during the night. Their findings suggest that sleep boosts intelligence in women but not in men.

Professor Martin Dresler from the Max Planck Institute in Munich, Germany, has been studying sleep spindles during the dreamless, non-rapid eye movement state of sleep. Sleep spindles vary in length and intensity and occur in different regions of the brain. Previously, scientists have speculated that intelligence is linked to sleep spindles, but Professor Dresler has carried out the largest study so far in 160 adults with a broad range of IQ to determine the association.

The team studied the sleeping brains of 72 women and 88 men during the night. "Sleep spindles are not well understood," said Professor Dresler, speaking today (6 July) at Europe's largest neuroscience conference in Copenhagen. "Are people with more sleep spindles more intelligent? Are spindles a marker of cognitive function and IQ? So far, it has been hard to draw conclusions, partly because of the small numbers of people participating in previous research studies."

Research on a larger group of people and restricting his analysis to the most likely associations, Professor Dresler found that there were significant differences between men and women based on standardised fluid intelligence tests that measure reasoning and problem solving. There was a positive correlation between intelligence and slow sleep spindles in women but not in men. The results were consistent taking into account the range of ages and IQ scores.

Professor Dresler thinks that spindles might indicate the integrity of white matter in the brain that connects the different regions of information-processing grey matter. This in turn would contribute to basis of intelligence. "In line with our results, IQ scores correlate much higher with measures of white matter integrity in females compared to males. In other words, in females there is a more straightforward relationship between these neural structures and their function in intelligence compared to males, which can also be seen in the sleep EEG," he said.

By contrast, in a study of 86 men (but not women) having an afternoon nap of 100 minutes, Dr Dresler's team found that there was a link between slow sleep spindles and intelligence, similar to the correlation seen for women during night sleep. The sleep data in men suggests a fundamental difference between night and daytime sleep, possibly because hormones behave differently according to whether it is night or day.

"Our results demonstrate that the association between sleep spindles and intelligence is more complex than we have assumed until now. There are many factors involved in intellectual abilities, and sleep is just one of them. This large study of men and women give us a more accurate framework for the next phase of research which will involve differences in individuals' sleep patterns." Professor Dresler concluded.

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During sleep, the hippocampus – an area of the brain linked to memory - distributes these new memories into existing networks via another specialized brain area, the prefrontal cortex which co-ordinates thoughts and actions.

Dr Lisa Genzel from the University of Edinburgh, Scotland, has investigated the role of sleep spindles in people with depression or schizophrenia. She has found that the consolidation of their memories of motor tasks is disturbed. While healthy people show an overnight increase in performance which is dependent on sleep, patients with schizophrenia and depression fail to show the same improvement.

Working with sleep scientists and neuroscientists at the Max Planck Institute of Psychiatry in Munich, they taught healthy people and depressed or schizophrenic patients (16 people in each group) a simple finger tapping sequence. They scanned the people’s brains both during the learning process and again the following day to measure the brain activity.

“When we compared the ability to learn the finger-tapping sequence, we found that that the deficit in the people with schizophrenia and depression is caused by a decreased connectivity between the hippocampus and the prefrontal cortex,” said Dr Genzel. She believes that this contributes to the progression of the disease.

END

Abstract Reference Dresler – Sleep spindles and general intelligence in humans
Genzel – Sleep spindles from physiology to function

Symposia S54: the role of sleep spindles in neuroplasticity, arousal and cognition

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NOTES TO EDITORS

The 10th FENS Forum of Neuroscience, the largest basic neuroscience meeting in Europe, organised by FENS and hosted by the Danish Society for Neuroscience will attract an estimated 6,000 international delegates. FENS mission is to advance research and education in neuroscience within and outside Europe, to facilitate interaction and coordination between its members. FENS represents 43 national and single discipline neuroscience societies with about 24,000 member scientists from 33 European countries. <http://www.fens.org/>

Further Reading

Sleep Spindles and Intelligence: Evidence for a Sexual Dimorphism Umja P, Genzel L, Dresler M *Journal of Neuroscience*, December 3 2014, 34(49) 16358-16368

Medial Prefrontal-Hippocampal Connectivity and Motor Memory Consolidation in Depression and Schizophrenia Genzel L, Dresler M *Biological Psychiatry* January 15 2015, Volume 77, Issue 2, Pages 177-186