The brain starts to eat itself after chronic sleep deprivation

Sleep loss in mice sends the brain's immune cells into overdrive. This might be helpful in the short term, but could increase the risk of dementia in the long run

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By **ANDY COGHLAN**

Missing sleep can cause long-term harm
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Burning the midnight oil may well burn out your brain. The brain cells that destroy and digest worn-out cells and debris go into overdrive in mice that are chronically sleep-deprived.

In the short term, this might be beneficial – clearing potentially harmful debris and rebuilding worn circuitry might protect healthy brain connections. But it may cause harm in the long term, and could explain why a chronic lack of sleep puts people at risk of Alzheimer's disease and other neurological disorders, says Michele Bellesi of the Marche Polytechnic University in Italy.

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Bellesi reached this conclusion after studying the effects of sleep deprivation in mice. His team compared the brains of mice that had either been allowed to sleep for as long as they wanted or had been kept awake for a further eight hours. Another group of mice were kept awake for five days in a row – mimicking the effects of chronic sleep loss.

The team specifically looked at glial cells, which form the brain's housekeeping system. Earlier research had found that a gene that regulates the activity of these cells is more active after a period of sleep deprivation.

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One type of glial cell, called an astrocyte, prunes unnecessary synapses in the brain to remodel its wiring. Another type, called a microglial cell, prowls the brain for damaged cells and debris.

Bellisi's team found that after an undisturbed sleep, astrocytes appeared to be active in around 6 per cent of the synapses in the brains of the well-rested mice. But astrocytes seemed to be more active in sleep-deprived mice – those that had lost eight hours of sleep showed astrocyte activity in around 8 per cent of their synapses, while the cells were active in 13.5 per cent of the synapses of the chronically sleep-deprived animals.

This suggests that sleep loss can trigger astrocytes to start breaking down more of the brain's connections and their debris. "We show for the first time that portions of synapses are literally eaten by astrocytes because of sleep loss," says Bellesi.

For all we know, this may be a good thing. Much of the remodelling was of the largest synapses, which are more mature and used more intensively. "They are like old pieces of furniture, and so probably need more attention and cleaning," says Bellesi.

But the team also found that microglial cells were more active after chronic sleep deprivation.

This is a more worrying find, says Bellesi; excessive microglial activity has been linked to a range of brain disorders. "We already know that sustained microglial activation has been observed in Alzheimer's and other forms of neurodegeneration," he says.

The finding could explain why a lack of sleep seems to make people more vulnerable to developing such dementias, says Agnès Nadjar of the University of Bordeaux in France.

It's not yet clear whether getting more sleep could protect the brain or rescue it from the effects of a few sleepless nights. The researchers plan to investigate how long the effects of sleep deprivation last.

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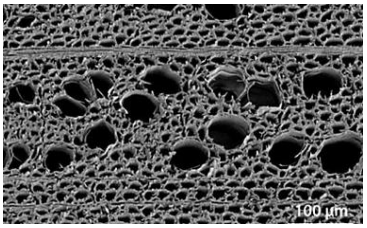

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