Light at night causes changes in brain linked to depression

November 17 2010, by Jeff Grabmeier

Exposure to even dim light at night is enough to cause physical changes in the brains of hamsters that may be associated with depression, a new study shows.

Researchers found that female Siberian hamsters exposed to dim light every night for eight weeks showed significant changes in a part of the brain called the hippocampus.

This is the first time researchers have found that light at night, by itself, may be linked to changes in the hippocampus.

These alterations may be a key reason why the researchers also found that the hamsters exposed to dim light at night showed more depressive symptoms when compared to hamsters in a standard light-dark cycle.

"Even dim light at night is sufficient to provoke depressive-like behaviors in hamsters, which may be explained by the changes we saw in their brains after eight weeks of exposure," said Tracy Bedrosian, co-author of the study and doctoral student in neuroscience at Ohio State University.

Bedrosian and her colleagues presented the results Nov. 17 in San Diego at the annual meeting of the Society for Neuroscience.

The results are significant because the night-time light used in the study was not bright: 5 lux, or the equivalent of having a television on in a

darkened room, said Randy Nelson, co-author of the study and professor of neuroscience and psychology at Ohio State.

"You would expect to see an impact if we were blasting these hamsters with bright lights, but this was a very low level, something that most people could easily encounter every night," said Nelson, who is also a member of Ohio State's Institute for Behavioral Medicine Research.

The study involved female Siberian hamsters, which had their ovaries removed to ensure that hormones produced in the ovary would not interfere with the results.

Half were housed in a standard light-dark cycle of 16 hours of light (at 150 lux) and eight hours of total darkness. The other half were housed in 16 hours of daylight (150 lux) and eight hours of dim light (5 lux).

After eight weeks in their lighting condition, they were tested for depressive-like behaviors. These tests are the same ones used by pharmaceutical companies to test anti-depressive and anti-anxiety drugs in animals before they are used in humans.

One depression test, for example, measured how much sugar water the mice drank. Mice generally like the drink, but those with depressive-like symptoms will not drink as much, presumably because they don't get as much pleasure from activities they usually enjoy.

Results showed that hamsters that lived in the dim light at night showed more symptoms of depression compared to the hamsters in the standard light-dark cycle.

At the end of the experiment, the researchers examined the hippocampus area of the hamsters' brains.

Results showed that mice that lived in the dim light had a significantly reduced density of dendritic spines – hairlike growths on brain cells, which are used to send chemical messages from one cell to another.

"The hippocampus plays a key role in depressive disorders, so finding changes there is significant," Bedrosian said.

The researchers found no difference between the two groups of hamsters in terms of concentrations of the stress hormone cortisol. That's important because hormones like cortisol have been linked to changes in the hippocampus.

"To the best of our knowledge, this is the first study to document that light at night is a sufficient stimulus to induce changes in the hippocampus, without changes in cortisol levels," Nelson said.

How is light at night causing the changes in the hippocampus? The researchers believe it is related to production of the hormone melatonin. Light at night suppresses secretion of melatonin, which is involved in how the body knows it is nighttime.

The lower levels of melatonin at night may be the cause of the lower density of dendritic spines in the hippocampus, Bedrosian said.

The researchers are continuing this work by investigating the exact role of melatonin in the findings of this study.

These results are consistent with an earlier study by Nelson and his colleagues which found that constant bright light at night is linked to depressive symptoms in male mice. In another recent study, they found that light at night is also linked to weight gain in mice.