The circadian clock: Understanding nature's timepiece

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New light on a complex mechanism

A cluster of brain cells less than half the size of a pencil eraser tells you when to wake up, when to be hungry and when it's time to go to sleep. The same cells also cause you to be disoriented after you've flown across multiple time zones.
The human circadian clock, comprised of about 20,000 time-keeping cells, has mystified scientists since it was pinpointed in the brain about 30 years ago. Now, a researcher at the University of Calgary is getting a little bit closer to understanding how it ticks.

Dr. Michael Antle, a neuroscientist in the U of C's Department of Psychology, has conclusively shown that the 20,000 cells are organized in a complex network of groups that perform different functions – contrary to the previously held belief that each cell did the same thing. Antle, an emerging leader in the field, has two new papers on the subject: one is featured on the March cover of the prestigious Trends in Neurosciences, and another is due out in a forthcoming issue of the Journal of Neurosciences.

"There are enormous health, safety and economic benefits to figuring out how the circadian clock works," Antle says. "We are probably still at least 10 years away from developing a pill that could reset your circadian clock to eliminate jet lag, but this new perspective in how the cells are organized definitely improves our understanding."

For every hour of time change a person experiences it takes about a day to fully adjust. Workers on rotating shifts are constantly struggling to adapt and they experience well-documented health problems as a result. For example, one study found that nurses who work nights or rotating shifts are at greater risk for developing breast cancer than their counterparts on regular day shifts.

"If your sleep schedule is constantly changing, you can't help but be less alert," Antle says. "When you look at disasters such as plane crashes, or Three Mile Island or Chernobyl, there is often a sleep-deprived person with critical responsibilities behind it all. When someone shifts their schedule, we want to find a way to shift their body with them so they remain alert, working optimally and making the right decisions."

Antle also hopes to experiment further with a technique that involves resetting the circadian clock by altering serotonin levels, the same neurotransmitter that the anti-depressant Prozac targets. He says it could one day be possible to move people ahead eight hours simply with a pill and light therapy.

All terrestrial organisms – even single-celled organisms – have circadian rhythms. In some cases, the circadian clock contributes to survival strategies as simple as not drying out when the sun comes up. Plants and animals have their own environmental niches and also unique temporal niches, as any cat owner can tell you.

Source: University of Calgary