

# Dark matter DNA active in brain during day-night cycle

September 24 2012

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(Medical Xpress)—Long stretches of DNA once considered inert dark matter appear to be uniquely active in a part of the brain known to control the body's 24-hour cycle, according to researchers at the National Institutes of Health.

Working with material from [rat brains](#), the researchers found some expanses of DNA contained the information that generate biologically active molecules. The levels of these molecules rose and fell, in [synchrony](#) with 24-hour cycles of light and darkness. Activity of some of the molecules peaked at night and diminished during the day, while the remainder peaked during the day and diminished during the night.

The material came from the [brain structure](#) known as the pineal gland. Located in the center of the [human brain](#), the pineal gland helps regulate the body's responses to day and night cycles, the researchers explained. In the evenings and at night, the pineal gland increases production of [melatonin](#), a hormone that synchronizes the body's rhythms with the cycle of light and dark. In many species, the pineal gland also plays a role in seasonally associated behaviors, such as hibernation and mating, as well as in [sexual maturation](#).

The biologically active material arising from the pineal gland DNA is called long noncoding RNA (lncRNA). The lncRNA is distinct from the better-known [messenger RNA](#) (mRNA), which serves as a kind of template to translate the information contained in DNA for the manufacturing of proteins. The lncRNAs appear instead to be involved

in activating, blocking or altering the activity of genes or influencing the function of the proteins, or acting as scaffolds for the organization of complexes of proteins. The researchers' use of next-generation sequencing methods detected the lncRNA activity in addition to the [mRNA](#) they originally targeted, which helped them in making their discovery.

"These lncRNAs come from areas of the [genome](#) that we thought were quiet," said senior author David Klein, Ph.D., head of the Section on Neuroendocrinology at the NIH's Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), in much of the research was conducted. "But current research in the field makes it unequivocally clear that the information-carrying capacity of the genome is a lot greater than we realized previously."

The study was a collaboration between Dr. Klein and NIH colleagues at the NICHD; the National Human Genome Research Institute (NHGRI); the NIH Intramural Sequencing Center, administered by NHGRI and the Center for Information Technology. In addition, researchers from King's College London; the University of Copenhagen, in Denmark; the Genomatix Software company, in Munich contributed to the study.

Their findings appear online in the *Proceedings of the National Academy of Sciences*.

To conduct their analysis, the researchers examined RNA from the pineal glands of rats exposed to cycles of 14 hours of light and 10 hours of darkness. The researchers identified 112 lncRNAs with 24 hour cycles. For nearly 60 percent of these lncRNAs, the rats' DNA produced twice as many lncRNA [molecules](#) at night as during the day. In addition, nearly 90 percent of the lncRNAs were produced in significantly greater quantities in the pineal gland than in other tissues of the body, most of which did not have detectable levels of these lncRNAs.

The researchers also disrupted the rats' regular day–night light cycle by turning on a light during a typical dark period. Within 30 minutes of the light going on, most of the lncRNAs decreased by half.

The role of the pineal gland lncRNAs is unclear; however, they have circadian patterns of activity. Dr. Klein previously documented [hundreds of genes in the pineal gland with consistent day-night cycles of activity](#).

"The lncRNAs show such strong activity, they obviously have something to tell us about the biology of daily body rhythms," Dr. Klein said. "We are only beginning to understand how the pineal gland helps maintain the body's 24 hour rhythms."

**More information:** For more information, visit the Institute's website at [www.nichd.nih.gov/](http://www.nichd.nih.gov/) .

Provided by National Institutes of Health

Citation: Dark matter DNA active in brain during day-night cycle (2012, September 24)  
retrieved 18 April 2024 from  
<https://medicalxpress.com/news/2012-09-dark-dna-brain-day-night.html>

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