Scientists pinpoint link between light signal and circadian rhythms

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In a new paper published this week in the *Proceedings of the National Academy of Sciences*, Aziz Sancar, MD, PhD, the Sarah Graham Kenan Professor of Biochemistry and Biophysics in the UNC School of Medicine, and his colleagues have taken an important step in understanding the underlying molecular signals that influence a broad array of biological processes ranging from the sleep-wake cycle to cancer growth and development.

Scientists who work in this field, known as chronobiology, have identified the genes that direct circadian rhythms in people, mice, fruit flies, fungi and several other organisms. However, the mechanisms by which those genes interact with light in the organism's environment have not been well understood.

Circadian rhythms are the physical, mental and behavioral changes that follow the earth's 24 hour cycle, responding primarily to light and darkness in an organism's environment.

About 15 years ago, Sancar discovered a human protein called cryptochrome which acts as a core component of the molecular clock in mammals. The protein is also found in fruit flies, other insects, and plants.

"Cryptochrome 'resets' the circadian clock, but we were not sure how it worked," said Sancar, who is also a member of UNC Lineberger Comprehensive Cancer Center.

Using fruit flies (Drosophilia melanogaster), the team purified cryptochrome and developed a biochemical test that shows when and how the protein transmits signals.

"We can now detect the protein at work. When we expose cryptochrome to blue light in fruit flies, a millisecond of light exposure has a half-life during which we can examine the mechanism in the laboratory," said Sancar. "We can follow the molecular signals after light exposure and have a reliable model to test various hypotheses about how light interacts with the circadian systems we know are so important to biological processes."

The research may be useful to scientists who study the circadian clock's relationship to sleep disorders, jet lag, cancer, bipolar disorder, depression and other diseases.

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