Separating morning and evening in the circadian clock of mammals

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Work by researchers at the universities of Aberdeen and Nottingham suggest an anatomical basis for the adaptation of the mammalian circadian clock to changing day-length.
Endogenous circadian clocks ensure that temporal patterns of physiology and behavior predict environmental changes determined by the Earth's rotation and orbit of the Sun. Such clocks are synchronized by the daily light-dark cycle.

A key question for circadian biologists concerns the way in which seasonal changes in day-length alter the behavior of circadian clocks over the course of the year. One idea for which evidence has accumulated is that circadian clocks contain coupled "morning" and "evening" oscillators that are separately synchronized to dawn and dusk.

In the new work, published in this week's issue of Current Biology, Dr David Hazlerigg and colleagues considered the possibility that distinct populations of neurons within the principal mammalian circadian clock (the suprachiasmatic nuclei of the hypothalamus, SCN) might constitute these different oscillators. By measuring gene-expression rhythms in the SCN of hamsters held on different day-lengths, they were able to show that cells in the caudal region of the SCN synchronize their gene-expression rhythms to dawn and, when the day-length is increased, exhibit earlier peak expression relative to midday.

The researchers also report a lesser, but opposite, response in cells in another group of neurons, the rostral SCN. Hence, synchronous gene

expression across the SCN may be a hallmark of short-day acclimation, whereas regional de-synchrony increases on long days.

Further studies are needed to discern whether this phenomenon translates into distinctive day-length-induced changes in rhythmic output from different regions of the SCN. Abnormalities in the adaptation of the SCN to changing day-length may underlie the development of seasonal affective disorder (SAD) in humans.

Source: University of Aberdeen