Jet-lag? Blame your body's clock

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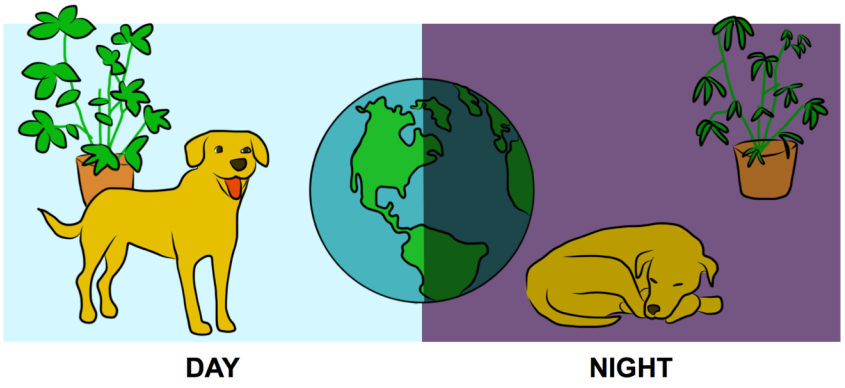
Plants, animals and humans are adapted to Earth's rotation

For many years we have known that living organisms, including humans, have an internal biological clock that helps them anticipate and adapt to the regular rhythm of the day. For example, the mimosa plant opens its leaves towards the sun during the daytime and closes them at dusk; and dogs sleep at night and remain pretty active during the daytime. The circadian rhythm – from the Latin words *circa* meaning "around" and *dies* meaning "day" – explains how plants, animals and humans adapt their biological rhythm so that it is synchronized with oscillations of day and night caused by Earth's rotations (nobelprize.org).

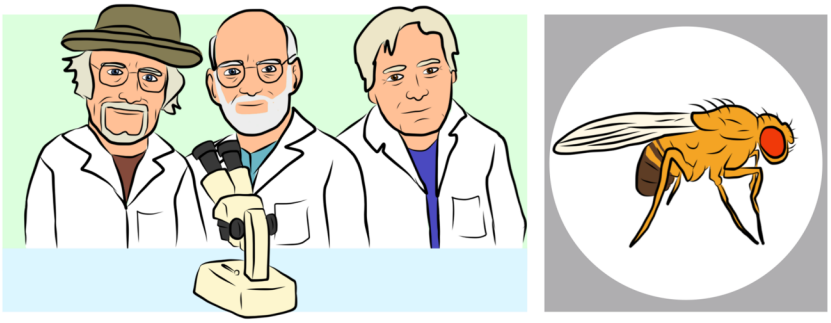
These circadian rhythms are ancient and highly conserved throughout evolution. Circadian rhythms have been observed in unicellular organisms, including fungi, as well as plants, insects, rodents, and humans. This suggests that the ability to optimize behavior according to the amount of light in our environment has been incredibly important for the success of organisms (Nobel-Committee)... so important, that a group of scientists was recently awarded a Nobel Prize for discovering more about how this all works.



The Nobel Prize-winning molecular mechanism of the body clock

The scientists Jeffrey C. Hall, Michael Rosbash and Michael W. Young were recently awarded with the Nobel Prize in Physiology or Medicine for 2017. They discovered how our biological clock works and helps to prepare our physiology for the fluctuations of the day. Using fruit flies as model organism, they isolated

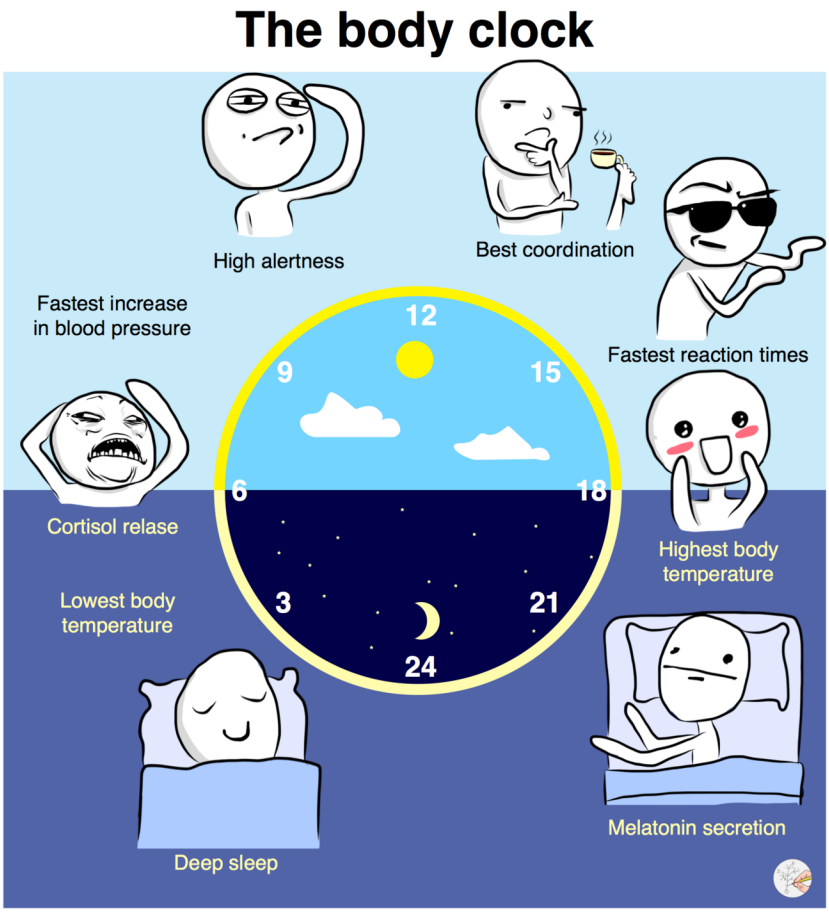
a gene that controls the normal daily biological rhythm. They discovered that PER, the protein encoded by the gene *period*, accumulated during the night and was degraded during the day. Thus, PER protein levels oscillate over a 24-hour cycle, in synchrony with the circadian rhythm (Siwicki et al., 1988). Subsequently, they identified additional protein components of this machinery, exposing the mechanism governing the self-sustaining clockwork inside the cell. We now recognize that biological clocks function by the same principles in cells of other multicellular organisms, including humans. These discoveries explain how plants, animals and humans adapt their biological rhythm so that they are synchronized with the Earth's rotation (nobelprize.org)



Scientist discovered how our biological clock works studying fruit flies

Jet-lag and the circadian rhythms

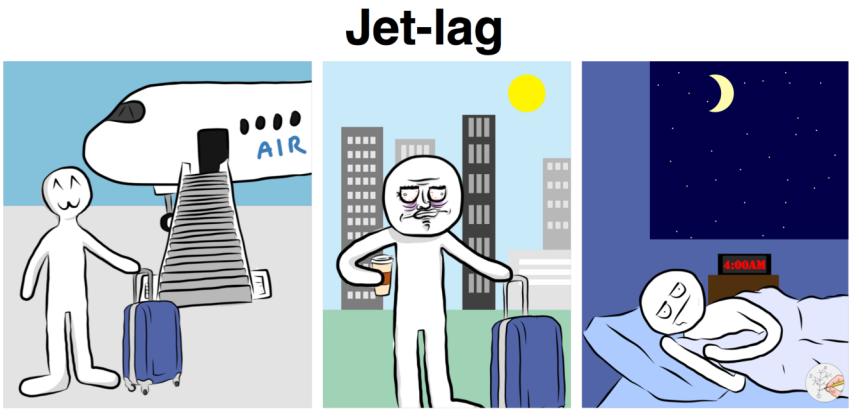
We might not notice our biological clock working day to day, but if you've ever been jet lagged then you'll realize how important it is to keep this clock in check! Normally humans sleep at night and are active during the daytime. Variables associated with activity and food intake, such as core temperature, blood pressure, plasma adrenaline and urinary excretion, are higher in the daytime than at night, whereas those associated with recuperation (plasma growth hormone and cortisol, for example) are higher at night. But if you've ever flown across time zones for business or holidays, you may be familiar with the uncomfortable, exhausting experience known as jet-lag. The fatigue, lack of concentration, and interrupted sleep at night mean poor physical and mental performance and a lot more errors. Some people also experience loss of appetite and indigestion or upset bowels. All of these effects are caused by multiple, complex processes, but a key player is the 'body clock' (Waterhouse, 1999a).



Dealing with Jet-lag

Jet-lag can occur any time you travel quickly across two or more time zones. The more time zones you cross, the more likely you are to be sleepy with more intense and longer symptoms. Many methods, both pharmacological and behavioral, have been used to alleviate the negative results of time-zone transitions. Some examples are: 1) simulating your new schedule before you leave by changing the timing of eating and napping. 2) Adapting to your new schedule while in flight by changing your watch and trying to sleep if it's nighttime where you are going or stay awake if it is day time where you are going. 3) Staying hydrated before, during, and after your flight to counteract dehydration. 4) Light therapy, the light helps shift your body's circadian clock, so you feel rested and wake at appropriate times of your destination. Commercially available light boxes may also be helpful in coping with jet lag if used at appropriate times. 5) Minimize sleep distractions during the flight or at your room at bedtime (cop; Waterhouse, 1999b).

As light is a key input for maintaining the 24 hour human circadian rhythm, people living at Arctic and Antarctic latitudes with less balanced (and fluctuating) day/night hours make for an interesting case study of how to adapt to changes in circadian rhythm (Arendt, 2012). But until we understand more about how to control our body's responses to changes in circadian rhythm, it might be based to practice regular sleeping routines and habits to avoid the nasty negative side of changing rhythms.



Contributions

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Ernesto Llamas wrote the text and made the illustrations. He obtained his PhD in Biotechnology from Universitat de Barcelona doing his research at Centre for Research in Agricultural Genomics (CRAG). Creator of Sketching Science. You can follow him on Instagram as @eellamas.

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