

Cyclical changes in cell membranes could have a significant impact on health and disease

July 10 2015



Fatty acid composition in human cell membranes changes throughout the day.
Credit: Susanne Schwaiger

Life is subject to natural rhythms, such as the light and dark cycle or seasonal variation in temperature. A recent study by researchers at the Vetmeduni Vienna, shows that the composition of human cell membranes varies depending on the time of day. These cyclical changes in cell membranes could have a significant impact on health and disease. The results were published in the *Journal of Biological Rhythms*.

Fatty acids are important components of cell membranes. They have signalling functions within the cells and play a role in controlling metabolic processes in the entire body. Thomas Ruf and Walter Arnold of the Research Institute of Wildlife Ecology at the University of Veterinary Medicine, Vienna, investigated these cyclic fluctuations in human cells.

"Nearly all physiological processes in humans and animals, such as body temperature or heart rate, undergo [daily rhythms](#), and many even exhibit annual fluctuations. We wanted to find out if these rhythms are related to changes in cell membranes," explains first author Thomas Ruf.

The researchers investigated buccal mucosa cells in 20 subjects over a period of one year. Study participants collected their cells on a predetermined day every month at three hour intervals by intensively rinsing their mouths with water and then freezing the samples in special flasks.

The composition of fatty acids changes during the course of the day

The analysis of the cell membranes revealed significant daily rhythms in eleven fatty acids. Several fatty acids were present in higher concentrations at night, others during the daytime. "The cellular changes have one thing in common: they always occurred at about the same time

in all participants. This shows that a clear rhythm is present," Ruf explains.

"From animal physiology, we know that the fatty acid composition in cell membranes can be remodelled in response to environmental conditions. Fatty acid composition is especially subject to seasonal fluctuations. However, while the participants of our study all showed daily fluctuations, seasonal changes occurred only in individual cases."

In contrast to wildlife, no clear annual rhythm could be seen in the fatty acid patterns of the study participants. Around one half of the subjects showed yearly rhythms, but these were not synchronous. Some participants exhibited a peak in spring or in summer, while in others the same fatty acid had higher concentrations in autumn or in the winter. "In western countries, seasons are having an increasingly smaller impact on the body. This is due to the prevalence of artificial light, which makes for longer days, and the long heating season, which minimises temperature fluctuations. Annual rhythms still exist, but these are no longer synchronised with the seasons," says Ruf.

Certain diseases occur in seasonal rhythms

This remodelling of human cell membranes could be of medical importance. It is known that certain fatty acids such as [omega-3 fatty acids](#) offer protection against certain diseases, while others, if taken up in excess, can have negative effects. The composition of the fatty acids in cell membranes may therefore have a variety of different health consequences.

"This may also explain why certain diseases and even death occur at specific times of day. Statistically speaking, heart attacks occur more often in the morning than in the evening. Blood pressure usually rises before noon. We currently do not know exactly what causes the changes

in the composition of the cell membranes. The type of food eaten and the time of food intake may also play a role. These questions must still be researched," Ruf points out.

In addition to consuming sufficient quantities of important healthy fatty acids such as omega-3 [fatty acids](#) in fish oil or oleic acids in olive oil, it may also be important to choose the right time for intake.

More information: "Daily and Seasonal Rhythms in Human Mucosa Phospholipid Fatty Acid Composition." *Journal of Biological Rhythms*. DOI: [10.1177/0748730415588190](https://doi.org/10.1177/0748730415588190)

Provided by University of Veterinary Medicine—Vienna

Citation: Cyclical changes in cell membranes could have a significant impact on health and disease (2015, July 10) retrieved 5 May 2024 from <https://medicalxpress.com/news/2015-07-cyclical-cell-membranes-significant-impact.html>

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