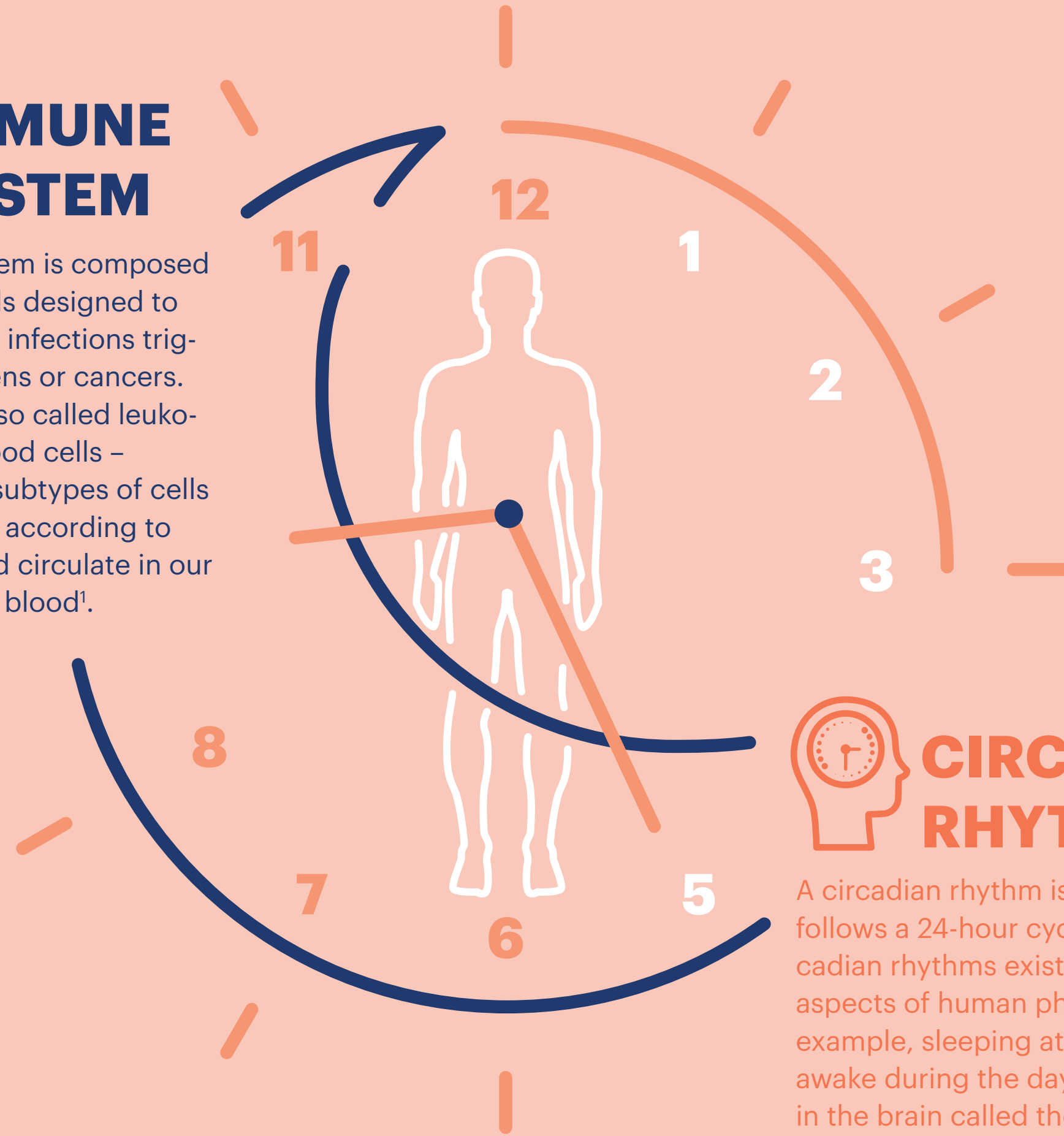


IMMUNE SYSTEM AROUND THE CLOCK

FOR OUR IMMUNE SYSTEM, DAILY RHYTHM OF LIFE MATTERS.

IMMUNE SYSTEM

The Immune System is composed of organs and cells designed to fight diseases like infections triggered by pathogens or cancers. Immune cells – also called leukocytes or white blood cells – include different subtypes of cells that are classified according to their function, and circulate in our body through the blood¹.



CIRCADIAN RHYTHMS

A circadian rhythm is a change that follows a 24-hour cycle. Different circadian rhythms exist that drive many aspects of human physiology. For example, sleeping at night and being awake during the day. A master clock in the brain called the suprachiasmatic nucleus coordinates the circadian rhythms in our body^{2,3,4}.



RESEARCH & INNOVATION

1-NIH Publication No. 03 5423 Sept 2003. 2-NIH_National Institute of General Medical Sciences, Oct 2020. 3-Wang et al. (2022), doi: 10.1126/sciimmunol.abm2465. 4-Haspel et al. (2020), doi: 10.1172/jci.insight.131487. 5-Ella et al. (2016), doi: 10.1016/j.bbi.2016.04.016. 6-Poole et al. (2022), doi: 10.1007/s00281_022_00921-z. 7-Brooks et al. (2020), doi: 10.1007/s00281_020_00820_1. 8-Giri et al. (2021), doi: 10.3389/fnins.2021.674204.

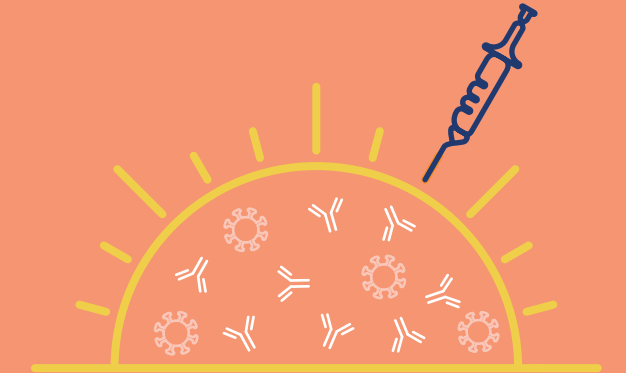
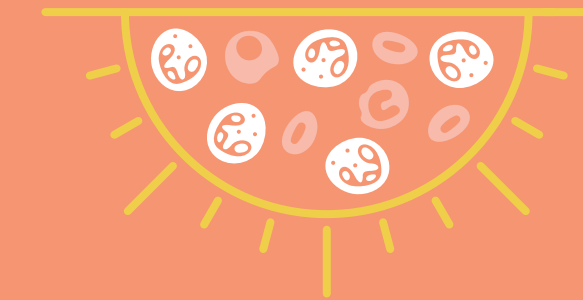
EFFECT ON THE IMMUNE SYSTEM AND HEALTH

The immune system is one of the functions that exhibits circadian rhythmicity. The number and/or activity of immune cells oscillate during the day. Some examples:



The number of **leukocytes** in the blood peaks during the rest phase (night) in humans^{3,4}.

Neutrophils are a subtype of immune cells and their number in the blood as well as their **capacity to eliminate pathogens** reach a maximum in the evening⁵.



Upon vaccination, the immune system produces **antibodies** to protect us against specific pathogens. For the **influenza and COVID-19 vaccines**, this production is higher in patients vaccinated in the morning as compared to the afternoon or the evening³.

Elucidating the daily modulations of the immune system allows to build new strategies like **chronotherapy**.



Chronotherapy

It is an emerging approach where medication is administered in sync with circadian rhythms. For example, patients suffering from rheumatoid arthritis experience a peak of pain in the morning hours as a result of a high level of pro-inflammatory substances produced by the immune system throughout the nighttime. Giving them anti-inflammatory drugs during the night reduces efficiently their morning symptoms⁸.

Did you know?

Sleep affects circadian immunity. **The circadian activity of the immune system is altered by disruptions of normal sleeping habits**, for example through shift work, frequent time zone travels or sleep deprivation. In night-shift workers, the impact is an elevated **level of inflammatory substances** in the blood^{3,4} and an increased **susceptibility to infections**^{6,7}. So, embracing healthy sleeping habits can help normalize the circadian rhythm and the good functioning of our immune system.

