

Have a hard time waking up when it's cold out? Scientists say blame your brain

A study conducted by neurobiologists from Northwestern University made it possible to elucidate the mechanisms underlying this phenomenon.

Their study on fruit flies, has found a thermometer circuit can transfer information about cold temps from their antennas right to the brain.

They show how, through this circuit, seasonally cold and dark conditions can inhibit neurons within the fly brain that promote activity and wakefulness, particularly in the morning.

"This helps explain why -- for both flies and humans -- it is so hard to wake up in the morning in winter," said Marco Gallio, associate professor of neurobiology in the Weinberg College of Arts and Sciences. "By studying behaviors in a fruit fly, we can better understand how and why temperature is so critical to regulating sleep."

The study, led by Gallio and conducted in *Drosophila melanogaster*, was published in the journal *Current Biology*.

The paper describes for the first time "absolute cold" receptors residing in the fly antenna, which respond to temperature only below the fly's "comfort zone" of approximately 77 degrees Fahrenheit.

Having identified those neurons, the researchers followed them all the way to their targets within the brain. They found the main recipients of this information are a small group of brain neurons that are part of a larger network that controls rhythms of activity and sleep. When the cold circuit they discovered is active, the target cells, which normally are activated by morning light, are shut down.

"Temperature sensing is one of the most fundamental sensory modalities," said Gallio, whose group is one of only a few in the world that is systematically studying temperature sensing in fruit flies. "The principles we are finding in the fly brain -- the logic and organization -- may be the same all the way to humans. Whether fly or human, the sensory systems have to solve the same problems, so they often do it in the same ways."

为啥一到冬天起床就特别困难？真不是因为懒

美国西北大学神经生物学家进行的一项研究或许能解释导致这种现象的机理。

他们在对果蝇的研究中发现了一个温度提示回路，可以将低温信息从触角传输到大脑。

研究显示，通过该回路，季节性寒冷和黑暗环境可以抑制果蝇大脑中促进活动和清醒的神经元，特别是在早晨。

温伯格文理学院神经生物学副教授马可·加利奥表示：“这有助于解释为什么无论对苍蝇还是人类来说，在冬天的早上醒来都很困难。通过研究果蝇的行为，我们可以更好地理解温度对调节睡眠的重要性。”

这项研究由加利奥主导，研究对象为黑腹果蝇，研究成果发表在《当代生物学》杂志上。

这篇论文首次介绍了果蝇触角中的“绝对寒冷”感觉神经元，它们只对低于果蝇温度舒适区的气温作出反应。果蝇感到适宜的温度接近 25 摄氏度。

在识别出这些神经元后，研究人员一直追踪，发现了它们在大脑中对应的靶细胞。研究人员发现这些信息的主要接收者是一小群大脑神经元细胞，它们是控制活动和睡眠规律的大脑神经网络的一部分。当温度提示回路被激活时，通常可以被晨光激活的这些靶细胞就会休息。

加利奥的研究团队是世界上为数不多的系统研究果蝇温度感应的团队之一，他表示：“温度感应是最基本的感觉方式之一。我们在果蝇大脑中发现的原理——逻辑和组织结构——可能对人类来说都是一样的。无论苍蝇还是人类，感觉系统都必须处理同样的问题，因此它们的处理机制通常也是相似的。”