MEDICINE

Medicine Nobel Prize Goes to Circadian Rhythm Researchers

Three U.S. scientists share the 2017 award

By Dina Fine Maron on October 2, 2017 أعرض هذا باللغة العربية

Credit: Jonathan Nackstrand *Getty Images*

The 2017 Nobel Prize in Medicine or Physiology will go to a trio of American circadian rhythm researchers, the Nobel Committee announced Monday in Stockholm. Jeffrey Hall and Michael Rosbash, who performed their award-winning work at Brandeis University, share the honor with The Rockefeller University's Michael Young for their seminal discoveries explaining how living creatures—including plants, animals and humans—adapt their biological rhythms to align with Earth's rotation.

At the time of the announcement, around 5:30 A.M. Eastern time, the Nobel Committee

had not yet been able to reach Young but had notified the other winners.

Circadian rhythm explains why, when there is a temporary mismatch between our external environment and our internal biological clocks—like when we travel across several time zones—humans experience “jet lag.” It also can help explain why humans sleep better in darkness. Like most other organisms, we have an internal clock that adapts to day and night—a cycle called circadian, from the Latin words *circa* meaning “around” and *dies* meaning “day.”

Starting in the 1980s the award-winning researchers specifically identified the underlying mechanisms that control fruit flies’ internal 24-hour cycles. They found which genes help influence these oscillations in the bugs, and explained the feedback loop that regulates the involved genes and myriad bodily rhythms.

The existence of an inner “clock” in living species was first described in the 18th century,

when astronomer Jean Jacques d'Ortous de Mairan found that even if mimosa plants were exposed to constant darkness, their leaves still followed a regular 24-hour rhythm. Other researchers found that such daily oscillations occurred in other animals and humans. This year's Nobel winners identified the internal machinery in the body that underlies these physiological processes.

In the 1980s Hall and Rosbash, working together at Brandeis, and Young, at Rockefeller, isolated the *period* gene in flies. When that gene is disrupted, they found, it throws off the insects' circadian clocks. Hall and Rosbash also discovered that a certain protein called PER, encoded by *period*, would accumulate during the night and degrade during the day. The importance of this work was that they found PER protein levels fluctuate over a 24-hour cycle—aligned with the circadian rhythm. They further theorized that an inhibitory feedback loop of the PER protein blocks the activity of the *period* gene, so the protein could prevent its own synthesis and thus regulate its own levels in a constant rhythm.

Young, in 1994, also furthered the understanding of circadian rhythms by explaining how the protein that builds up in cells during the night got there in the first place. He discovered a second clock gene, called *timeless,* that encodes another protein, TIM, which is required for a normal circadian rhythm. When TIM partners with PER, he found, the two proteins together are able to enter a cell nucleus and block *period* gene activity, closing the inhibitory feedback loop. The Nobel laureates' discoveries helped fuel the growth of this vast field, and build understanding of how organisms anticipate and react to day/night cycles. Researchers now know our biological clocks help regulate sleep patterns, feeding behavior, hormone release, blood pressure and the body's temperature, among other vital processes.

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Dina Fine Maron, formerly an associate editor at *Scientific American*, is now a wildlife trade investigative reporter at *National Geographic*.

Credit: Nick Higgins

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