

'Tis the Season

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For APS Fellow Irving Zucker, there really is a reason for the seasons — or at least the seasonal rhythms of mammals — and it's melatonin. Zucker studies biological and behavioral rhythms generated by an internal timer set by environmental changes in day length.

“The first reason [to study seasonal rhythms] is that behavioral phenotypes change markedly as a function of the seasons,” said Zucker. “And if you stop and think about it, an organism having to cope with spring and summer conditions has to engage in different kinds of behaviors than it would in the middle of winter. In terms of research on seasonality in particular, the influence that daylight has on many parameters has had enormous economic significance in agriculture horticulture, animal production, and medicine.”

Day length effects pineal melatonin secretion, which signals the neuroendocrine system and behavioral phenotypes to be in either long day mode or short day mode. In short day mode, melatonin secretion is elevated for 10 to 12 hours. In long day mode, melatonin is elevated for 5 to 6 hours. Zucker stresses that melatonin levels are related to light and not just a passive responsive to darkness. Although melatonin is sometimes used to manipulate our 24-hour circadian rhythm, for example to combat jet lag, its actual physiological purpose is to set these seasonal cycles. Any relationship between melatonin and circadian rhythm is purely pharmacological and is not related to its actual biological purpose.

Zucker's talk highlighted his work with Siberian hamsters — which exhibit seasonal changes in fur color, body mass, testis size, fat, sex behavior, and torpor — and meadow voles which display seasonal variation in female social behavior. Zucker's research model requires keeping subjects in a completely constant environment for three years, so he has not expanded his work to humans. But, other studies of patterns in the suicide rate, mortality rate, time of first coitus, and sudden infant death syndrome all show seasonal cycles.

According to Zucker, who is retiring from teaching in June after 43 years at the University of California, Berkeley, environmental seasonality reflects evolution and adaptation. The seasons were a basic component of the ecosystem in which our ancestors evolved and therefore, “dealing with seasons has left its mark on our make-up in terms our biology and behavior.”