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Rusak B & Zucker I. Biological rhythms and animal behavior. *Annu. Rev. Psychol.* 26:137-71, 1975.
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This review of diverse rhythms in animal behavior included a description of formal models and physiological substrates underlying daily and seasonal periodicity. The importance of endogenous rhythms for experimental design as well as species-typical adaptations was stressed. [The *SCI*® and *SSCI*® indicate that this paper has been cited in over 130 publications, making it the most-cited paper from this journal.]

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With one notable exception, psychologists neglected the study of biological rhythms prior to 1970; Curt P. Richter was the only psychobiologist concertedly investigating basic and clinical aspects of rhythmicity in animals and humans, and his contributions over six decades were significant for their empirical content and in encouraging others to enter the field.[1] His and other studies established that many rhythms in behavior were truly endogenous and originated within animals rather than being imposed from without. The so-called spontaneity of behavior has long been a central issue in motivation and of prime interest to psychologists. Research on biological rhythms lent a new perspective to this classical problem.

The growing awareness among psychologists and others in the 1960s that living organisms are not in a temporal steady state and that behavioral and physiological relations may be valid only for one time of day or season of the year stimulated interest in the sources of biological rhythmicity. The discovery that the suprachiasmatic nuclei (SCN) of the hypothalamus were crucial to the normal generation and synchronization of several behavioral rhythms in rats[2] also attracted attention to biological-rhythms research.

The time appeared ripe for a review of the scattered literature implicating endogenous rhythmicity as a factor to be considered in formulating theories of motivation. I was gratified, therefore, when my colleague Mark R. Rosenzweig, then as now editor of the *Annual Review of Psychology*, asked me to prepare such a review. I was joined in this endeavor by Benjamin Rusak, at the time "just a graduate student" but already manifesting the formidable scholarly skills that subsequently led to his selection as the founding editor of the *Journal of Biological Rhythms*. In addition to reviewing the subject matter with which we were familiar through our own research, we used this occasion to educate ourselves and subsequently our readers about developments in chronobiology that had applications for the study of behavior. In particular, the description of formal models of biological rhythms, based on analogies to physical oscillators,[3] had not previously seen the light of day in the psychological literature and since has engaged the interests of a number of psychologists.

This article has most likely been highly cited primarily because it provided a convenient, concise summary of many aspects of behavioral rhythms and because it provided the only review available in 1975 of the role of the SCN in biological rhythms. Like most such summaries it was superseded by a more detailed, comprehensive account of neural aspects of circadian rhythms,[4] by a broad survey of vertebrate behavioral rhythms,[5] and by a discussion of the significance of rhythms for motivational phenomena.[6] What lingers most in memory is the wonderful camaraderie and intellectual excitement engendered by my collaboration with Rusak in preparing this review.

1. **Richter C P.** *Biological clocks in medicine and psychiatry*. Springfield, IL: Thomas, 1965. 108 p. (Cited 255 times.)
2. **Stephan F K & Zucker I.** Circadian rhythms in drinking behavior and locomotor activity of rats are eliminated by hypothalamic lesions. *Proc. Nat. Acad. Sci. USA* 69:1583-6, 1972. (Cited 350 times.)
3. **Pittendrigh C S.** Circadian oscillations in cells and the circadian organization of multicellular systems. (Schmitt F O & Worden F G, eds.) *The neurosciences, third study program*. Cambridge, MA: MIT Press, 1974. p. 437-58. (Cited 240 times.)
4. **Rusak B & Zucker I.** Neural regulation of circadian rhythms. *Physiol. Rev.* 59:449-526, 1979. (Cited 340 times.)
5. **Rusak B.** Vertebrate behavioral rhythms. (Aschoff J, ed.) *Handbook of behavioral neurobiology*. New York: Plenum, 1981. Vol. 4. p. 183-213.
6. **Zucker I.** Motivation, biological clocks, and temporal organization of behavior. (Satinoff E & Teitelbaum P, eds.) *Handbook of behavioral neurobiology*. New York: Plenum, 1983. Vol. 6. p. 3-21.