

Short Report

A Circadian Locomotor Rhythm in the Giant Land Snail, *Achatina fulica*

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OGASAWARA, T. and TASAKI, K. *A Circadian Locomotor Rhythm in the Giant Land Snail, Achatina fulica*. Tohoku J. exp. Med., 1982, 137 (1), 109-110 — A circadian rhythm in the locomotor behavior of the giant land snail, *Achatina fulica*, was studied by a running wheel method in a 24 hr light-dark cycle (LD 12:12) and also in constant dim light. The locomotor rhythm could be entrained to the LD cycle, and the entrained rhythm was characterized by the bulk of activity in the dark period, the major activity appearing in the first half of the dark period. In constant dim light the locomotor rhythm free-ran with a period of about 24 hr. circadian rhythm; locomotor behavior; *Achatina fulica*

Circadian behaviors in some gastropod molluscs have yet been studied, especially in two species, one the marine gastropod, *Aplysia californica* (Jacklet 1972) and the other the giant garden slug, *Limax maximus* (Sokolove et al. 1977). These two molluscs have also been used for the study of cellular mechanisms underlying complex behaviors (Strumwasser 1971; Prior and Gelperin 1974).

The present report describes the circadian locomotor rhythm in the African giant snail, *Achatina fulica*, which may be a model system for the neurophysiological investigations of circadian behaviors of higher animals.

The snails were transported from Okinawa Prefecture and kept in the laboratory under natural light cycles. They were fed a diet of sweet potato and cabbage. Animals weighing between 20 and 40 g were used in the present experiments and they were not given food throughout the experiment.

The locomotor activity was monitored using a running wheel similar to those developed for studying the activity of *Aplysia* (Jacklet 1972) and *Limax* (Sokolove et al. 1977). Each 1/8 wheel revolution which corresponded to about 10 cm moving distance of the animal was recorded as an upward or downward pen-deflection on a channel of an 8-channel event recorder.

Artificial lighting in the light-tight room was controlled by a timer. Fluorescent light sources were used and light intensities measured at the bottom of the wheel were about 300 lux in the lighted portion of the LD cycle and 0.2 lux in the constant dim light condition. Room temperature was $22.0 \pm 0.5^\circ\text{C}$ and relative humidity was maintained over 95% throughout the experiment.

Fig. 1A shows a typical example of the entrained locomotor rhythm of an individual snail in LD 12:12 cycle. Snails were found to be nocturnally active with the major activity appearing in the first half of the dark period, although a small activity occurred within 1 hr before the light-dark transition and immediately after the dark-light transition. A

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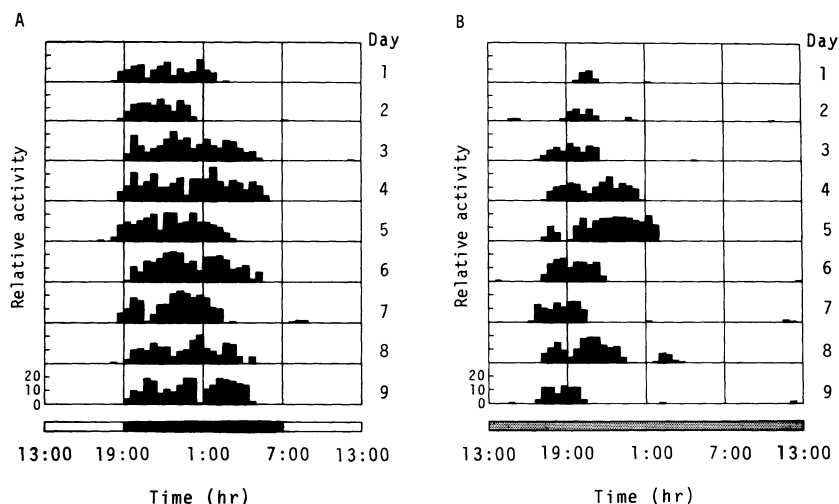


Fig. 1. The entrained (A) and free-running (B) rhythms of individual *Achatina* specimens in nine successive days. The experiments started two days before the first days in each panel. Animals were kept in natural light cycles and fed a diet till they were transferred into the running wheels. The bars at the bottom designate the lighting schedules of LD 12:12 cycle (left panel) and constant dim light (right panel). The black portion indicates the complete dark period of the LD cycle. Relative activity means the number of pen-deflections in each 30-min interval.

circadian free-running rhythm in constant dim light was also studied in individual animals. An example of one animal is shown in Fig. 1B. Although some individual differences were noted, the locomotor rhythm persisted with a period of nearly 24 hr until the termination of the recording period.

These results resemble those described by Sokolove et al. (1977) concerning the circadian behavior of *Limax maximus*. These two species of molluscs showed similar entrained pattern of their locomotions to LD 12:12 cycle, and free-ran in constant environment with a period of about 24 hr. It should be noted, however, that *Limax* was capable of free-running in constant illumination at relatively low temperature (15°C) but failed to exhibit a clear rhythm at 20 or 22°C which is suitable temperature for *Achatina*.

References

- 1) Jacklet, J.W. (1972) Circadian locomotor activity in *Aplysia*. *J. comp. Physiol.*, **79**, 325-341.
- 2) Prior, D.J. & Gelperin, A. (1974) Behavioral and physiological studies of locomotion in the giant garden slug *Limax maximus*. *Malacological Rev.*, **7**, 50-51.
- 3) Sokolove, P.G., Beiswanger, C.M., Prior, D.J. & Gelperin, A. (1977) A circadian rhythm in the locomotor behaviour of the giant garden slug *Limax maximus*. *J. exp. Biol.*, **66**, 47-64.
- 4) Strumwasser, F. (1971) The cellular basis of behavior in *Aplysia*. *J. Psychiat. Res.*, **8**, 237-257.