

nuclei was less than in that dehydrated animals, while the cytoplasm of the neurosecretory cells in hydrated animals also showed a state of degeneration (unpublished results). Electron microscopic studies showed cells of CA of dehydrated animals with prominent nucleus and dense cytoplasm containing plenty of mitochondria and a few golgi bodies; Endoplasmic reticulum was not observed; Cell boundaries were distinct and nuclei contained one or two large nucleoli (figure 1). Ultrastructural studies of CA of hydrated animals revealed indications of disintegration such as insignificant cytoplasm, large intracellular space and degenerating cell organelles; cell boundaries were not distinct but nuclei were intact (figure 2). In both dehydrated and hydrated conditions the CA contained neurosecretory axons with plenty of granules.

Taking gland volume, cell appearance and nuclear size as criteria for determining the activity status of CA⁴ in *O. rhinoceros*, it appears that the CA of the dehydrated animal remains in an active state while in the hydrated animal, CA becomes degenerate and inactive. In insects such as *Leucophaea maderae*⁵, *Locusta migratoria*⁶ and in *Eurygaster integriceps*⁷ active and inactive states of CA have been described on the basis of similar characteristics. In *Schistocerca gregaria* allatectomy induces water accumulation in the body⁸. However, it is difficult to state at present whether the CA has any role in water balance. It is probable that the effect is indirect or secondary and due to changes in activity of other endocrines in response to dehydration or hydration stress¹⁻³.

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MECHANORECEPTORY REGULATION OF PREDATOR EVASION BEHAVIOUR IN THE COCKROACH, *PERIPLANETA AMERICANA*

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EVASIVE responses to mechanical stimuli provide for escape from predators in thysanuran¹ and orthopteroide insects². Air movements or sound vibrations caused by the approaching predator are the effective stimuli in the crickets and cockroaches in which the mechanoreceptive hairs on the abdominal cerci supply sensory input to a set of giant interneurons in the terminal abdominal ganglion². Giant interneuron activity elicits rapid running or a jump that serves to evade an approaching predator^{1,2}.

Our objective was to examine the role of the abdominal cerci of the cockroach, *Periplaneta americana*, in predator evasion and to understand whether the processing of sensory input in the neural circuitry of the escape system of cockroach is rhythmic.

Natural predators of both nocturnal (scorpion, *Heterometrus fulvipes*³, and toad, *Bufo malanosticus*) and diurnal (lizard, *Calotes nemoricola*⁴) nature were used. The scorpions were maintained in man-made burrows in a terrarium and the lizards, toads and cockroaches were maintained in cages. Predator animals were starved for 24 h before experimentation. Cercectomy (unilateral and bilateral) was performed on cockroaches one day prior to experimentation. Cockroaches were allowed to move near the entrance of the scorpion burrow and the toad cages with the door opened at 20 h of the day, while the lizards were allowed to feed on the cockroaches at 08 h of the day. A predator animal was discarded after the first successful attempt.

The number of escapes from attacks of the nocturnal predators, scorpion and toad, was more in cockroaches with intact cerci (control) than in cercectomised (unilateral or bilateral) cockroaches (table 1). Among the cercectomised animals, those with no cerci (bilateral cercectomy) were more susceptible to capture by predators. The highly reduced escape efficiency in cercectomised animals suggests the involvement of mechanoreceptive cercal filiform hairs in eliciting evasion behaviour. The toads were found to be more efficient predators on cockroaches than the scorpions. In contrast to the nocturnal predators, the diurnal predator,

Table 1 Escape efficiency of cockroach, *Periplaneta americana*, in response to attack by selected predators

Predator	Condition of prey (cockroach)	No. of strikes	No. of escapes	Per cent escape	Mann-Whitney ⁷ U-test
<i>Bufo melanostictus</i>	Normal	54	26	48.15	
	Unilaterally cercectomised	46	11	23.91	$P < 0.01$ (1 vs 3) $P < 0.01$ (2 vs 3) $P > 0.05$ (1 vs 2)
	Bilaterally cercectomised	34	4	11.76	
<i>Heterometrus fulvipes</i>	Normal	40	23	57.5	
	Unilaterally cercectomised	31	14	45.2	$P < 0.01$ (1 vs 3) $P < 0.01$ (2 vs 3) $P > 0.05$ (1 vs 2)
	Bilaterally cercectomised	21	3	14.2	
<i>Calotes nemoricola</i>	Normal	25	10	40.0	
	Unilaterally cercectomised	24	10	41.67	$P < 0.01$ (1 vs 3) $P < 0.01$ (2 vs 3) $P > 0.05$ (1 vs 2)
	Bilaterally cercectomised	25	9	36.0	

$P < 0.01$: Significant; $P > 0.05$: Not Significant.

Calotes nemoricola, was found to be a more successful predator on cockroaches as revealed by the low rate of prey escape (table 1). Furthermore, predator evasion ability was almost the same in normal and in deafferented (cercectomised) cockroaches (table 1). Since cockroaches are nocturnal animals⁵ they become more susceptible to capture by predators during the daytime than in the night.

These observations suggest a rhythmic sensory input into the neural circuitry of the escape system in the cockroach which would alter the predator evasion efficiency of these animals during light and dark hours of a solar day. A circadian pattern of giant-fibre-mediated spontaneous activity has been reported in cockroaches⁶ and further supports this assumption.

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TRANSPORT OF YELLOW MITE *POLYPHAGOTARSONEMUS LATUS* BY COTTON WHITEFLY

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CERTAIN insects have been reported to transport mites on their bodies from one host to another and