

Influence of Recurrent Nerve Severance on Haemolymph Proteins in *Periplaneta americana* L.

The median neurosecretory cells, as well as the corpus allatum, have been found to influence protein metabolism in insects¹⁻⁵. The role of the recurrent nerve which innervates the gut of insects⁶ has not been investigated in this connection, although it is an important pathway to the gut for neural and hormonal stimuli⁷⁻⁹. Hence it was thought worthwhile to investigate the effect of recurrent nerve severance on the haemolymph protein concentration in an insect, as haemolymph is the likely medium to be affected by any change in protein metabolism.

Female cockroaches (*Periplaneta americana*) under ether anaesthesia were surface sterilized with 80% ethyl alcohol at the site of operation. The recurrent nerve was severed just behind the nervi cardio-stomatogastrici through an incision made on the dorsal sclerite of the neck. After introducing a crystal of streptomycin sulphate, the wound was sealed with molten paraffin. Controls were kept in which all procedures were carried out except nerve severance. The animals had free access to biscuits and water. All animals were bled between 115 and 145 days after the operation by pleural puncture. The blood was collected in capillary tubes, sealed with plasticine and centrifuged at 0 °C in a refrigerated centrifuge. The clear serum was used for disc electrophoresis after the method of REISFELD et al.¹⁰. Stained electrophorograms were scanned using a Canalco microdensitometer and the quantities of proteins in different fractions estimated against similar preparations of a crystalline bovine serum albumin standard.

The experimental animals were fed as well as the controls. The haemolymph protein patterns of the experimental and control animals are shown in the Figure, and the concentrations of proteins in different fractions are summarized in the Table. Of the total of 9 protein fractions found in the haemolymph of the female cockroach¹¹, in fractions 3 and 4 which are the major fractions, there is a conspicuous fall in concentration of proteins. Fractions 2, 4, 5, 6, 7 and 8 are not at all recognizable in the experimental animal. The average

Concentration of proteins in $\mu\text{g}/\mu\text{l}$ in different fractions of the haemolymph of *Periplaneta americana* 115-145 days after recurrent nerve severance

Experimental groups	Major fractions 3 and 4	Minor fractions	Total
I. Females after recurrent nerve severance	11.3 (7.8, 3.5)	6.7	18.0
II. Sham operated controls	35.6 (30.3, 5.3)	17.7	53.3

Crystalline bovine serum albumin was taken as standard. Each value represents an average of at least 5 animals.

total protein concentration in the experimental animal is $18.0 \mu\text{g}/\mu\text{l}$ which is only 34% of the control value.

The haemolymph protein concentration in insects is known to decrease after extirpation of the neurosecretory cells^{3, 12, 13}, as these components of the neuroendocrine complex of insects stimulate the synthesis of gut proteases⁵ or protein synthesis by the fat body. The gut in insects, especially in cockroaches, is well innervated by the stomatogastric nervous system⁶. Neurosecretory material is present along these nerves in aphids and cockroaches^{8, 9}. These authors also suggest the possibility of direct release of neurosecretory material contained in the stomodaeal nerves at the site of action, i.e. the gut. Hence it is presumed that the low protein concentration in the haemolymph of *Periplaneta* observed in the present study is due to a nervous or a hormonal disturbance of the synthesis of enzymes involved in protein digestion. It is concluded that recurrent nerve severance in female cockroaches results in a decrease of the haemolymph protein concentration due to decreased protease activity of the gut¹⁴.

Zusammenfassung. Es wird gezeigt, dass bei der weiblichen Schabe *Periplaneta americana* Durchtrennung des Nervus recurrens zu einer Reduktion der Hämolympheproteine führt.

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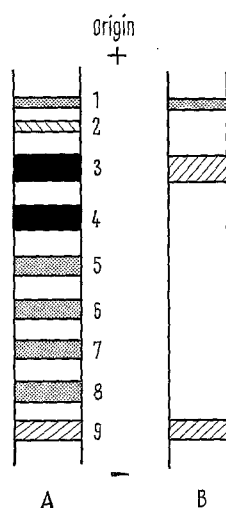


Diagram representing electrophorograms of the haemolymph proteins of *Periplaneta*. (A) control female; (B) female 143 days after recurrent nerve severance. Dark shading indicates highest concentration of proteins in a fraction; cross hatching and stipples, lesser and east concentration respectively.

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