Table II. Osmolarity (depression of the freezing point △ °C) in the hemolymph of larvae of about the same size 6 days after the last molt

	No. of observations	Mean value of △ °C $\pm s_{\bar{x}}$	Level of significance	
Normal animals	35	0.66 ± 0.014	$p > 0.05$	$p < 0.001$
One frontal connective cut (2 days before)	21	0.60 ± 0.033		
Both frontal connectives cut (2 days before)	35	0.75 ± 0.017	$p < 0.001$	
Both frontal connectives cut (3 days before)	12	0.86 ± 0.043	$p < 0.01$	

Temperature 28 ± 0.5 °C; about 100% RH.

both of the frontal connectives a significantly ($p < 0.001$) higher depression of the freezing point than in normal animals is to be observed. This operation has the same effect as the removal of the entire frontal ganglion. 3 days after cutting both the frontal connectives, the depression of the freezing point continued to increase. It is significantly higher than that after 2 days ($p < 0.01$). The difference in osmotic pressure of the hemolymph between normal animals and those with cut frontal connectives days after operation amounts to 2.4 atmosphere.

The increasing depression of the freezing point corresponds to a decrease in hemolymph volume. 3 days after cutting both the frontal connectives, it is already difficult to get samples of blood; later on it is quite impossible: no blood can be withdrawn from the fresh wounds.

These results show that starving animals lose much water when the frontal ganglion is removed or both the frontal connectives are cut. The loss in body weight is as large as with dead larvae under the same conditions. The animals with intact connection between the frontal ganglion and the tritocerebrum can reduce this water loss. A diuretic factor is located in the neurosecretory centres of the pars intercerebralis[7-9]. It is possible that the frontal ganglion receiving impulses from osmoreceptors exerts an inhibitory influence upon these neurosecretory centres. Cutting the connectives results in a loss of inhibition and consequently in an increasing release of the diuretic factor from the brain.

Zusammenfassung. Der Gewichtsverlust bei frontalganglionektomierten Schaben innerhalb von 24 h im Exsikkator ist wesentlich grösser als derjenige bei scheinoperierten Tieren. Er erreicht Werte, wie sie bei toten Tieren auftreten. Der Gewichtsverlust ist mit einer signifikanten Zunahme der Gefrierpunktserniedrigung in der Hämolymphe verbunden. Durchtrennung beider Frontalkonnektive hat dieselbe Wirkung wie Ganglionektomie.

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[7] M. J. Berridge, J. exp. Biol. *44*, 553 (1966).
[8] K. C. Highnam, L. Hill and J. Gingell, J. Zool., Lond. *147*, 201 (1965).
[9] W. Mordue, J. Insect Physiol. *15*, 273 (1969).

The Resistance of in situ Perfused Lymph Trunks and Lymph Nodes to Flow

During active or passive movements of a hindlimb, the pressure in its lymphatics increases[1]. When the flow of lymph is substantially increased by plasmapheresis, perinodal oedema develops[2]. The two phenomena presumably have a common cause: obstruction to the lymph flow by the lymph nodes. To see whether the nodes really obstruct the flow, we studied the relation obtaining between flow and pressure before and behind the nodes in the lymphatic system.

Dogs of either sex, weighing 14–20 kg, were anaesthetized with chloralose. In a group of 20 dogs the thoracic duct through the intestinal lymphatic trunk, and in one of 27 animals the lymph nodes in various body regions, through their afferent lymph vessels, were perfused in situ. The polyethylene cannula for perfusion of the thoracic duct was inserted through a 5 cm long central stump of the intestinal lymphatic trunk. For recording pressure, a lateral branch of the intestinal lymph trunk and the central stump of the left cervical lymphatic trunk were cannulated. A fine double-barrelled polyethylene cannula was introduced into an afferent lymphatic to within 5–10 mm of the lymph node; one barrel was used for perfusion, the other for pressure recording. A Schwarzer transducer and polygraph (Physioscript) were used. We perfused the thoracic duct with a 1:1 mixture of dog plasma and physiological saline (Harvard Peristaltic Pump: Model 500–1200), and the lymph nodes with physiological saline alone (Harvard Compact Infusion Pump: Model No. 975). The perfusion fluid was stained with Evans' blue to detect possible ruptures. Perfusion was started with 2.5 ml/min for lymph trunks, and mostly 0.005 ml/min for lymph nodes, and doubled every 2 min. Thoracic duct perfusion reached values occasionally exceeding 20 ml/min, and that of the lymph node 0.1–0.3 ml/min.

In the mathematical treatment of flow (F) and pressure (P) we proceeded from the equation $P = b\,(F)^a$ where F = perfusion rate and P = pressure increment (belonging to F) above baseline for thoracic duct perfusion, or F = perfusion rate less F_1 and P = pressure less P_1 for lymph node perfusion; P_1 is the pressure belonging to the lowest value of perfusion rate F_1.

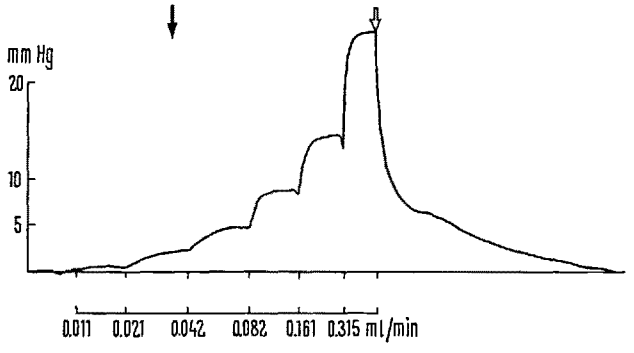
[1] C. K. Drinker and M. E. Field, *Lymphatics, Lymph and Tissue Fluid* (Williams and Wilkins Co., Baltimore 1933).
[2] M. Papp, Postdoctoral theses, Budapest 1970.

Exponent *a* was found to fluctuate about 1, wherefore single parameter straight lines were fitted to the P and F values. The *b* regression coefficients were averaged for each site of measurement and compared by analysis of variance using weighted average with the sum of squares as weights. The dimension of the regression coefficients equals that of the resistance expressed as mmHg/ml/min. The resistance of the thoracic duct to flow was calculated as the difference between the regression coefficients for the intestinal lymphatic trunk and for the cervical lymphatic trunk. Transection of the lymphatic efferent to the lymph node during perfusion was not followed by a fall in pressure in the afferent lymphatic, proving that it is the node which resists the flow: the resistance of the lymph node equals its regression coefficient.

The regression coefficient for the intestinal lymphatic trunk differed significantly from that for the cervical lymphatic trunk, and both differed from ∅ ($p < 0.01$) (Table). The resistance of the thoracic duct was 0.233 mmHg/ml/min.

Site of measurement	Regression coefficient (mmHg/ml/min)	
Intestinal lymph trunk	0.401 ± 0.063	(7)[a]
Left cervical lymph trunk	0.167 ± 0.044	(13)
Submandibular lymph node	51.4 ± 8.1	(7)
Mediastinal lymph node	152 ± 114	(3)
Periportal lymph node	113 ± 30	(6)
Popliteal lymph node	34.7 ± 5.9	(11)

[a] Arithmetic mean and S.E.; number of dogs in parenthesis.



In situ perfused popliteal lymph node: flow-to-pressure curve. ↓: transection of the efferent lymphatic was not followed by a fall in pressure; ⇓: interruption of perfusion reduced pressure to zero.

The resistance of the lymph node was roughly 100 times that of the thoracic duct (Table). Transection of the afferent lymphatic or interruption of perfusion reduced pressure to zero (Figure). No rupture of a perfused lymphatic was seen. When lymph nodes were perfused with 0.1–0.3 ml/min of fluid, the flow-to-pressure curve deflected towards the flow axis; that is, the resistance of the lymph nodes fell, as has already been observed by other workers[3].

Lymph flow so copious as to exceed the transport capacity of the lymphatic trunk is hardly conceivable in the organism; the less so as the lymph trunks are capable of transporting 10–20 ml/min, i.e. 2–3 times the total amount of the capillary filtrate (0.25% of the cardiac output)[4,5].

From this it seems to follow that functional (dynamic) insufficiency of the lymph circulation[6] develops not in the lymphatic trunk, but before it[7,8]. The extent to which lymph nodes obstruct lymph flow depends on the rate of flow: nodale resistance remains the same as long as the afferent lymphatic flow does not exceed 0.1–0.3 ml/min. The great resistance of lymph nodes to flow might explain the substantial increase in the pressure within the lymphatics in the leg during active or passive movement and why perinodal oedema develops when lymph flow substantially increases.

Résumé. Les ganglions lymphatiques perfusés sur place résistent à l'élévation du débit lymphatique; cette résistance peut favoriser le dévéloppement de l'œdème local.

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[3] N. L. BROWSE, R. L. DOIG and D. SIZELAND, J. Physiol., Lond. *208*, 77P (1970).
[4] E. M. LANDIS and J. R. PAPPENHEIMER, *Handbook of Physiology*, Sect. 2 (Eds. W. F. HAMILTON and PH. DOW; Am. Physiol. Soc., Washington, D.C. 1963), vol. 2, p. 987.
[5] M. PAPP, G. B. MAKARA, B. HAJTMAN and L. CSÁKI, Gastroenterology *51*, 524 (1966).
[6] I. RUSZNYÁK, M. FÖLDI and GY. SZABÓ, *Lymphologie, Physiologie und Pathologie der Lymphgefässe und des Lymphkreislaufes* (Akadémiai kiadó, Budapest 1969).
[7] M. PAPP and G. B. MAKARA, Acta physiol. hung., Suppl. *32*, 99 (1967).
[8] M. PAPP, G. B. MAKARA and B. HAJTMAN, Orv. Hetil. *109*, 2057 (1968).

Evidence of Phagostimulants in Cotton Leaves Eliciting Feeding of *Spodoptera littoralis* Bois

The cotton leaf worm *Spodoptera littoralis* Bois is polyphagous, but it prefers some of its hosts to the others. Studies on the feeding and growth of the insect on 27 species of host plants belonging to 16 families[1] show that 8 were refused, 5 were eaten to some extent and 14 were normally accepted and fully supported growth. Of the favorable host plants, cotton (*Gossypium barbadense* L.) is heavily attacked by the larvae. The results also confirmed that the acceptance by the larvae of the host plants is due probably to chemical rather than purely physical factors and hence chemical senses must be involved in the host plant finding.

Histological and behavioural studies show that the larvae bear chemoreceptors on the mouth parts. Following techniques of successive amputation of different parts confirm that the olfactory receptors are located on the antennae and maxillary palps, while the gustatory receptors are mainly localized on the labrum epipharynx. Successive amputation of the antennal and maxillary palpal segments exerted no effect on the discriminative ability of the larvae towards non-olfactory compounds like sugars and salts. The operated larvae were able to accept sucrose and reject ammonium chloride like normal individuals when they were allowed to drink drops of