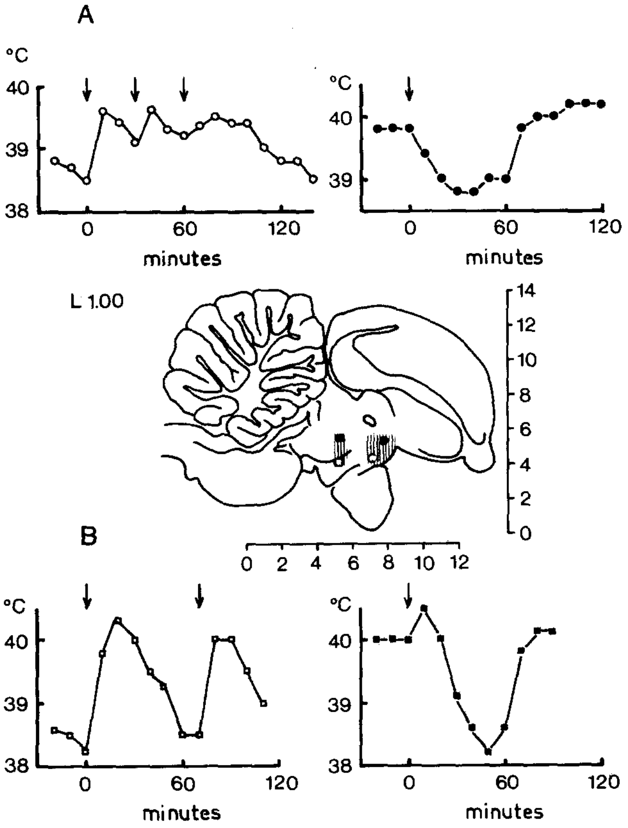
the thermoregulation[12] cannot be extended to birds[5], the present findings, together with some previous notes[8], complicate the view of action of this amine on avians. A sort of antagonism between 5-HT and NA may in fact exist, as suggested by the finding that NA (10 µg) at T_a 6 °C in all the birds of this experiment evoked hypothermia (T_b falls following injections into posterior and anterior aspects 2.6±0.25 °C and 3.3±0.57 °C, respectively, $\bar{x} \pm SE$).

Variable responses after intracranial injections of 5-HT have been observed in chickens[13], and in several species of mammals[14-18]. Comparison of the present results with this evidence is suggestive of the presence also in pigeon of 2 functionally different systems sensitive to 5-HT. One, located in the posterior hypothalamus, seems to mediate chiefly heat conservation and thermogenesis, and the other one, in the anterior hypothalamus, heat loss and decreased thermogenesis.

The effect of injection may depend crucially on the exact site, as has been demonstrated in cat[18]. It was also shown that different aspects even in the preoptic/anterior hypothalamic region (POAH) mediate different thermoregulatory responses. This might also partly account for the few inconsistent responses observed after injections of 5-HT into the different sites within the same brain region (either anterior or posterior hypothalamus) in the pigeon. The lack of extensive mapping for sites mediating these effects precludes further evaluation of function and significance of these systems as yet.

Short latency to the onset of the effect, and a rather short duration of action, suggests that 5-HT functions as a transmitter in the pigeon hypothalamus. The possibility of its modulatory role and functional connection with cholinergic and other monoaminergic systems cannot, however, be excluded.



Different temperature responses evoked by injections of 5-HT (10 µg) at the time indicated by the arrows into anterior (A, ○-○ and ●-●) and posterior (B, □-□ and ■-■) regions of the hypothalamus of 4 pigeons. Hatched area in the sagittal projection of the pigeon brain 1.00 mm from midline denotes the limits of cannula tips in the respective hypothalamic regions of all birds used.

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Influence of feeding conditions on wing, labellar and tarsal hair resistance in *Phormia regina* (Meig.)*

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Summary. Feeding enhances resistance of wing, tarsal and labellar hairs of *Phormia regina* Meig. The observed increase in resistance might be related to variations in the secretory function of the accessory cells at the hair sockets. The importance of this fact in feeding control is discussed.

The regulation of food intake in *Phormia* is achieved by either central and/or peripheral changes[1]. As regards peripheral changes, contradictory reports have been published. Getting et al.[2] did not note any frequency variation after feeding in spike discharges from labellar chemoreceptors, nor was Dethier[3] able to detect any alterations in salt

Table 1. Electrical resistance of wing hairs of *Phormia regina* Meig. after forced (21 µl 1 M sucrose in 30 min) or sham feeding. Mean percent values (as referred to electrical resistance before forced or sham feeding) of 26 experiments ± SE

		Time (min) after forced or sham feeding 0	10	20	30	40	50	60
Resistance (%)	Forced feeding	156.96** ± 15.30	204.27* ± 18.74	218.65* ± 16.28	254.67* ± 22.70	225.35* ± 24.78	183.58* ± 14.22	216.95* ± 22.87
	Sham feeding	102.95 ± 2.79	94.48 ± 3.89	93.57 ± 4.64	99.65 ± 2.73	99.35 ± 5.02	105.43 ± 3.95	97.61 ± 3.79

Force-fed insects differ significantly from the corresponding sham-fed ones. Student's t-test; * $p < 0.001$; ** $0.01 > p > 0.001$.

or water receptor function in thirsty flies as compared to water-satiated ones. On the contrary, Omand[4] reported that feeding may lower labellar taste hair response to water, salt and sugar. Bearing in mind that Stürckow[5] has suggested that a correlation may exist in a related species of dipterum *(Calliphora eritrocephala)* between labellar hair response and amount of viscous exudate at the hair tip, it seemed of interest to investigate whether changes in this secretion in *Phormia* as well might be related to feeding. Such changes can be appreciated by measuring hair electrical resistance: in fact, variations in the viscous substance that is located between the external environment and the chemosensory membranes in the taste hairs can modulate ionic fluxes on which resistance mainly depends[6]. Resistance measurements may consequently provide information about ion stimulating effectiveness. An increase in resistance means reduced ionic flux, and hence makes it more difficult, for any given ion, to reach the chemosensory sites from the external environment. In this paper we studied peripheral changes in the taste receptors of *Phormia* following food uptake by testing the electrical resistance of wing, labellar and tarsal hairs.

2-4-day-old adult blowflies, *Phormia regina* Meig., were used. The insects were reared at 27 °C, 75% relative humidity and fed with water and granulated sucrose; 15 h before the experiments, the chosen specimens were deprived of food. The experimental procedure was as follows: the blowfly was waxed to a glass rod of suitable diameter by its dorsal side, and hair resistance measured following a method described in previous papers[7]. After the resistivance tests, a 1st group of insects (force-fed insects) was hand-fed with 21 µl of 1 M sucrose solution through a microsyringe. Feeding was completed in 30 min by stimulating only the labellar hairs. In this way we avoided the effects arising from the inhibition of tarsal afference caused by food ingestion[2]. A 2nd group of insects (sham-fed insects) simply remained waxed to the experimental device for the same period of time as the force-fed ones. Resistance measurements were then performed again at 10 min intervals for 60 min. The variations in wing, tarsal and labellar hair resistance in *Phormia* before and after forced or sham feeding are reported in tables 1-3. Since we are more interested in resistance changes than absolute resistance measurements, the results are expressed as percentages of the initial resistance values. Among the hairs tested, the wing hairs show the highest increase after feeding (table 1, maximum + 154% at 30 min after feeding). The resistance values of these hairs are always significantly different from those observed in the wing hairs of the sham-fed insects ($p < 0.001$ with Student's t-test). Tarsal and labellar hairs also show augmented resistance after feeding, but to a lesser extent and with a lower significance level. In fact, as reported in table 2, the resistance of the tarsal hairs of force-fed insects is higher than its initial value (maximum + 33.47% at 50 min after feeding) and differs from the resistance of the corresponding hairs of the sham-fed insects at p's ranging from 0.05 to 0.001. The increase observed in resistance of the labellar hairs is the least evident one (table 3), inasmuch as there is a difference between force-fed and sham-fed insects only at 20 min after feeding ($0.02 > p > 0.01$). An increase in chemoreceptor resistance was observed in *Locusta migratoria* by Bernays et al.[8-10]. These authors demonstrated that feeding can cause the tips of the sensilla to close, thus reducing resis-

Table 2. Electrical resistance of tarsal hairs of *Phormia regina* Meig. after forced (21 µl 1 M sucrose in 30 min) or sham feeding. Mean percent values (as referred to electrical resistance before forced or sham feeding) of 20 experiments ± SE

		Time (min) after forced or sham feeding 0	10	20	30	40	50	60
Resistance (%)	Forced feeding	113.4* ± 3.66	117.50* ± 5.77	117.44* ± 5.74	131.25** ± 11.56	122.15* ± 5.22	133.47* ± 11.83	129.05* ± 10.68
	Sham feeding	96.00 ± 3.00	90.88 ± 3.75	96.63 ± 2.38	100.88 ± 3.73	98.50 ± 3.52	98.21 ± 2.37	102.07 ± 4.02

Force-fed insects differ significantly from the corresponding sham-fed ones. Student's t-test; * $0.01 > p > 0.001$; ** $0.05 > p > 0.02$.

Table 3. Electrical resistance of labellar hairs of *Phormia regina* Meig. after forced (21 µl 1 M sucrose in 30 min) or sham feeding. Mean percent values (as referred to electrical resistance before forced or sham feeding) of 21 experiments ± SE

		Time (min) after forced or sham feeding 0	10	20	30	40	50	60
Resistance (%)	Forced feeding	98.37** ± 2.28	102.43*** ± 3.48	107.04* ± 3.87	107.48** ± 4.19	109.29** ± 5.49	106.65** ± 3.56	110.47** ± 5.99
	Sham feeding	92.06 ± 1.33	95.44 ± 2.39	94.33 ± 2.32	97.33 ± 2.49	96.67 ± 2.89	98.28 ± 2.77	94.50 ± 6.05

* Force-fed insects differ significantly from the corresponding sham-fed ones. Student's t-test, $0.02 > p > 0.01$; force-fed insects do not differ significantly from the corresponding sham-fed ones. Same test as above, ** $0.1 > p < 0.05$ and *** $0.2 > p > 0.1$.

tance by hindering ion diffusion from the external environment to the chemosensory dendrites. As regards *Phormia*, opening or closing of the tips of the chemosensory hairs has been described[11], but this mechanism seems to be rather improbable under physiological conditions[12]. Graded changes in the fluid bathing the tips of the dendrites seems more likely in *Phormia* hairs[11] and this fits better with our results for the chemosensory hairs of *Phormia*. Bernays et al.[10] have demonstrated that the mechanism involved in resistance variations is based on hormonal changes in *Locusta*, whereas in *Phormia* humoral intervention on chemoreceptor function has been ruled out by means of parabiosis experiments[13]. Although our data do not provide any information in this respect, it is possible that an increased volume of the alimentary canal may affect the secretory functions of the accessory cells at the hair sockets aspecifically by simply increasing internal body fluid pressures. Because of their anatomical location, it seems likely that tarsal and wing hairs may be influenced more than labellar hairs by a pressure/volume variation mainly involving the thoracic and abdominal regions (where the crop is located). The crop is in fact the portion of the alimentary canal that increases most in volume after feeding. This latter hypothesis may explain the lower resistance increase that we observed in the labellar hairs as compared with tarsal and wing hairs. In conclusion, our data show that an increase in hair resistance, and hence a reduction in ionic fluxes between the external environment and the chemosensory dendrites, follows food ingestion. This may represent a possible further mechanism in feeding control.

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Electrophysiological characteristics of *Bombyx mori* L. ventral nerve cord (effect of sodium and potassium on the membrane potential)

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Summary. Na^+ and K^+ effects on the resting cellular membrane potential of desheathed ganglia of the *Bombyx mori* L. ventral nerve cord have been studied. The cells are depolarized by high concentrations of external potassium ions in the same way as in vertebrates, mollusca and crustacean cells. The possibility that the behaviour of the resting potential is not only influenced by the potassium equilibrium potential, but also by the conductances to other ions, is discussed.

A great number of experimental data has shown that in many animals potassium concentration is higher in the axoplasm than in the serum, while sodium concentration is higher in the serum than in the axoplasm and that the more important ions for the equilibrium across the cellular membrane are sodium, potassium and chloride. Preparations of excised nerve or isolated cells of these animals can maintain their excitability if perfused with Ringer solutions containing a large amount of sodium and a small amount of potassium and minor quantities of calcium and other ions together with the proper anions.

A very different situation has been found in some phytophagous insects whose hemolymph contains a large amount of potassium and a very small amount of sodium.

In these conditions, it seems difficult to reconcile this situation with the conventional membrane theory for the propagation of the action potential, which depends on the presence of a high Na^+ concentration in the fluid bathing the axon surface.

Aim of the present work is to characterize, from an electrophysiological point of view, the nervous system of the phytophagous larva of *Bombyx mori* L. in the last instar. These insects have an hemolymph richer in bivalent (Mg^{++}, Ca^{++}) than in monovalent (Na^+, K^+) cations, where the K/Na ratio is about 27[2,3].

The sodium concentration is very low, only 1.7 mM/l. The present paper reports experiments performed in order to assess the role of potassium and sodium ions in the maintenance of resting potential.

Materials and methods. Experiments were carried out on *Bombyx mori* larvae in their last instar. The animals were pinned ventral surface to a Sylgard 184 layer in a glass chamber. The dorsal integument was opened by a median longitudinal incision, the midgut removed and the exposed

Membrane potentials ± SE (mV)			ΔMP%	P
0 mEq (Na)	1.7 mEq (Na)	17 mEq (Na)		
48.7±0.4 (222)	48.6±0.5 (147)	–	+ 0.1	0.95*
–	40.4±0.4 (279)	28.8±0.4 (289)	– 28.7	<0.01

Mean values of the membrane potential ± SE for different sodium concentrations in the perfusing solution. * No significant difference between the results obtained in Ringer and sodium-free Ringer.