ed (unpublished data). In sum, it appears likely that certain regions of the amygdala may be involved in the vagosympathetic pathway. Such knowledge is of paramount importance in consideration of the physiological stimulus for the CVS arterial pressor response.

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Opposing temperature responses to intrahypothalamic injections of 5-hydroxytryptamine in the pigeon exposed to cold

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Summary. 5-Hydroxytryptamine injected into posterior and anterior parts of the pigeon hypothalamus evoked a short lasting hyperthermia or hypothermia, respectively. Variable responses obtained within the same brain region suggest the existence of different 5-HT systems, even in rather limited hypothalamic areas.

Although the anterior hypothalamus is generally thought to represent the main site of regulation of body temperature (T_b), structures in the posterior aspects have also been found to contain neurones controlling responses especially against cold[1]. While the pigeon brain stem has been shown to be rather insensitive to thermal stimulations[2], cerebral injections of putative neurotransmitters elicit responses suggesting thermoregulatory role on them[3-7]. In the pigeon, injection of 5-hydroxytryptamine (5-HT) into the anterior hypothalamus has been demonstrated to induce a slight hypothermia at an ambient temperature (T_a) of 15 °C[5]. At certain sites, however, a rise of T_b following 5-HT has been reported[8]. To ascertain the dual effect of 5-HT on T_b, injections were made into the posterior hypothalamic region, and the results compared with those obtained from experiments at more rostral locations.

Materials and methods. Using pentobarbital anesthesia, a guide cannula was implanted stereotaxically[9] into the hypothalamus of 9 domestic pigeons, weighing 260–330 g, 5.0–5.6 mm (modified coordinates[7,9]) anterior to the inter-aural line (posterior hypothalamus). The cannula extended 9.0–11.0 mm below the skull surface. 1 week was allowed for recovery from surgery.

During the experiments, pigeons exposed to T_a 6 °C were injected with a 5-HT solution in a volume of 1.0 µl containing 10 µg of salt (5-hydroxytryptamine creatinine sulphate, Merck) dissolved in distilled water. Methods of measurements of oxygen consumption, body and foot temperatures and shivering have been described earlier[10,11].

Additionally, results of similar injections using stereotaxic coordinates 6.5–8.0 mm anterior to the inter-aural line (anterior hypothalamus) were compared with those obtained from more caudal locations. Injections into the rostral aspects were made earlier in a different context but under similar conditions in our laboratory.

Results and discussion. Contrary to the results obtained earlier[5], injection of 10 µg 5-HT into the posterior hypothalamus did not exclusively induce hypothermia. Instead, a short lasting T_b increase of 1.0±0.27 °C ($\bar{x} \pm SE$) was evoked in 7 pigeons. The latency for the onset of temperature rise was 1–2 min, and the peak was achieved within about 20 min of injection. Hyperthermia was often accompanied by a substantial increase in the strength of shivering, and an increase of 14.2% on the average in the oxygen consumption. The results were reproducible as demonstrated by repeating the injection during the same experimental session. In 2 pigeons, the injection of 5-HT produced a biphasic temperature response: the immediate small rise (0.2 and 0.5 °C) with the peak within less than 10 min was followed by a hypothermia reaching nadir within 40–50 min.

Most of the injections (14 out of 22 made on equal number of birds) into a more anterior portion evoked hypothermic responses inducing T_b fall of 0.7±0.11 °C ($\bar{x} \pm SE$) thus confirming the previous report[5]. Injections into 5 pigeons produced increased shivering, however, and were followed by a rise of T_b (0.6±0.19 °C, $\bar{x} \pm SE$). In 2 birds, the injections were practically without effect, and in 1 case a biphasic response (T_b changes of +0.7 and −2.0 °C) was recorded.

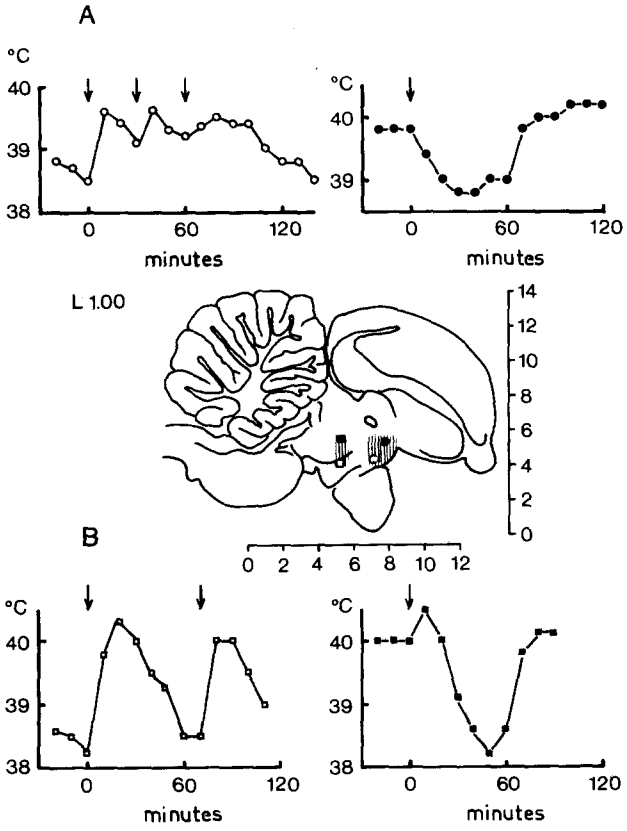
Despite the previous conclusion that the concept of noradrenaline (NA) and 5-HT acting as an antagonistic pair in

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