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THE INFLUENCE OF NECK SENSE ORGANS ON HEAD POSITION IN THE BLOWFLY *Calliphora Erythrocephala M.*

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Calliphora can turn its head about all three body axes (yaw and pitch ±20°, roll ±90°).
In the absence of external orienting cues, the fly, nevertheless, holds its head on average aligned with the trunk (see Figure, left columns). This could be due to stiffness of the neck skeleton, to symmetrical tension of neck muscles or to active control using neck sense organs. In *Calliphora*, a pair of chordotonal organs, and a pair of bristle fields (prosternal Organs, PO) are known in the neck region (Peters W. (1962) Z Morphol Ökol Tiere 51:211-226). Surgical elimination of these organs prevents the reactive flight torque, elicited by imposed head yaw (Liske E. (1978) PhD thesis Uni Darmstadt) and, similary, the resistance reflex against a roll torque imposed on the head of walking flies (Horn E. Lang H. (1978) J Comp Physiol 126:137-146). The specific roles of the two kinds of neck sense organs, however, are far from being clear. We illustrate the kinematics of the prosternal organs, and demonstrate their influence on head position by unilateral manipulation.

Each prosternal organ has about 110 mechanosensory, hairs arising from equally oriented sockets. At rest, ca 25% are deflected ventrad by a small overlying neck sclerite. With downward head pitch more hairs are deflected in both prosternal Organs. With head roll to the right, more hairs are bent in the right organ (RPO) and less in the left one. This suggests that prosternal organs could be used to control pitch as well as roll.

Head movements of *Calliphora* were video-recorded during tethered flight in a homogeneously white windtunnel, and measured over 1 min after flight start. Elimination of the right organ (RPO) by shaving the hairs elicits a steady head roll to the right (Fig la, middle) which vanishes again when the LPO is shaved too (Fig 1a, right). Conversely, if hairs of the RPO are continuously bent and arrested by wax, the fly rolls its head to the left (Fig 1b, middle) and this response vanishes if both POs are treated in the same way (Fig 1b, right).

These results show that head roll in *Calliphora* creates a specific bending pattern of mechanosensory hairs of the prosternal organs which in turn activates those neck muscles which return the head° appropriately.

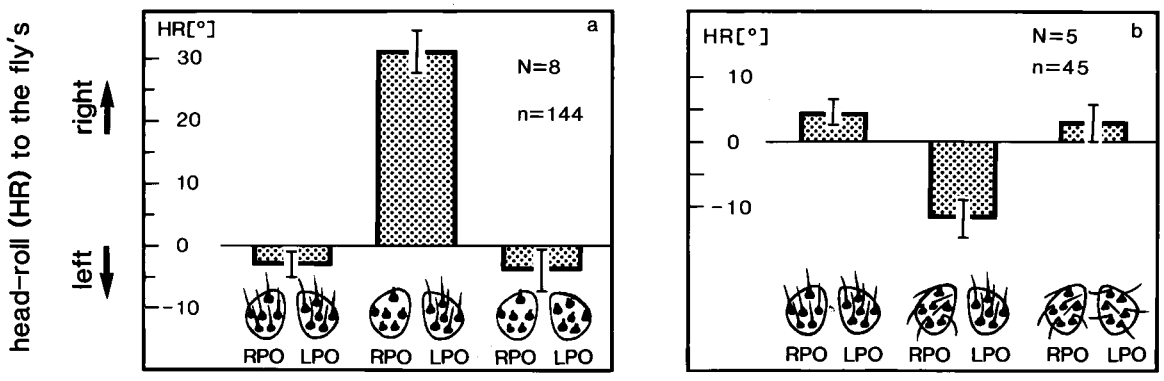

Figure: Steady state head roll of *Calliphora* during flight (a) with unilateral elimination and (b) with unilateral excitation of the right prosternal organ (RPO). Symmetrical experiments elicit no response.