Hence, the projections of the p-p vector in the two planes are very nearly parallel to the a- and the c-axes respectively. It is due to this, that we have failed to observe sufficient resolution between the Pake curves corresponding to the two vectors, which are non-equivalent only in respect of their ϕ_0-values. In the ac-plane, however, the spectra observed were typical of two non-equivalent p-p vectors. The parameters are also consistent with the results obtained in the other two planes.

Hydrogen bonding : Each Hg atom in the unit cell has two close neighbours : O(3) at 2·17 Å, and $O(H_2O)$ at 2·24 Å which are approximately collinear with Hg. The other four neighbours, O(2), are at the corners of a rectangle whose shorter sides are perpendicular to the mirror plane containing Hg, O(3) and $O(H_2O)$. This mirror is a symmetry requirement of this space group.

Our NMR results are consistent with two possible sets of hydrogen bonds, as follows :

(i) One involving the O(2) atoms not related by the mirror symmetry, and (ii) another involving the O(3) atoms from adjacent unit cells. The scheme (i) however leads to the protons being located along the edges of the co-ordination polyhedron and this is extremely unlikely.

The distances and angles calculated on the basis of the X-ray data are furnished along with the PMR results, for scheme (ii) in Table I.

The long bond distances involved suggest rather weak bonding ; this allows us to assume an O-H distance corresponding to the vapour value, viz., 0·96 Å. This, together with the observed H-H distances of 1·61 Å, gives $H-O(\hat{H}_2O)-H$ as 118° 58', which is near the $O(3)-O(H_2O)-O'(3)$. Hence, we are led to suggest that the bonding to the O(3) atoms of adjacent unit cells is the probable one. The proposed hydrogen bonding is illustrated in Fig. I.

Such a bonding appears to violate the mirror symmetry of the space group, and a neutron diffraction study of the crystal may be of interest.

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UNIT-HAIR RECEPTOR ACTIVITY FROM THE TELSON OF THE SCORPION, *HETEROMETRUS FULVIPES*

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LITTLE is known of the functional properties of hair receptors in scorpions. The mechanoreceptive function of hairs of scorpion was mentioned by Rao (1964) and Laverack (1966). According to Rao (1963) the 'B' type of hairs are principally mechanoreceptive and are distributed on the appendages, opistosoma and metasoma. Behavioral responses such as escape, attack, withdrawal and alert, etc., can be readily evoked either by delivering puffs of air onto the animal or by mechanically manipulating the hairs, thereby signifying the importance of these hairs in mediating behavioral responses of the animal. In spite of this fact, no one has reported an electrophysiological analysis of the properties of these hair receptors. One of the 'B' type of hairs on the enigmatic telson is chosen because of its easy accessibility for manipulation and also due to availability of long nerve for recording purposes.

The scorpion, *Heterometrus fulvipes* was used. The animal was fixed on to a dissection board with ventral side up and the telsonic nerve was exposed by carefully excising the exoskeleton. After severing the central connections the nerve was placed on a pair of silver-silver chlorided electrodes and the impulses were simultaneously led to a loud-speaker and Philips GM 5666 oscilloscope, after duly amplifying them with Type 122 Tektronix preamplifier. Recordings were made in air at room temperature (27° C.) and scorpion ringer (Padmanabhanaidu, 1967) was used to moisten the nerve. Two methods were employed to impart mechanical stimuli to the hairs. In one method, a needle mounted on a micromanipulator was used for brief and sustained displacement of the hair. The stimulus signal was monitored through a liquid potentiometer. The second device, employed mostly for high frequency stimulation, consists

of a probe fixed on to the diaphragm of a loud-speaker. The loud-speaker connected to a driver circuit was driven by a Tektronix pulse generator. Air puffs of varying intensity were manually blown on to the hair through a fine capillary tube.

The response to air puffs (Fig. 1) is a brief burst of activity, consisting of one or two spike components, depending upon the rate of air puffs delivered. For slow blowing only small spikes of 50μ V are obtained (Fig. 1 a). For rapid blowing the discharge consists of a burst of spikes of two amplitudes (Fig. 1 b); the small spikes of 50μ V and big spikes of 100 to 150μ V.

The hair should be moved at a critical rate to obtain the single spike response (Fig. 2 b). Movements below this critical rate were found to be ineffective in eliciting the response (Fig. 2 a). Beyond the critical rate of stimulus a stepwise increase in response frequency was obtained for increasing rates of stimulus (Fig. 2 c and d)

Sustained stimuli were applied by moving the hair far above the critical rate, left in the displaced state for some time and then spikes. Beyond the critical rate of movement, the response frequency is merely a function of rate of hair displacement. The response during the first 0·1 sec. corresponds to the high frequency zone when the instantaneous frequency is of the order of 200/sec.

The loud-speaker device was employed to cause small-scale vibrations of the hair at known frequencies. When the hair was subjected to stimulation at low frequences (10 to 40/s) the response was found to be in the form of bursts. For high frequency stimulation (100/sec.) the response was found to be in the from of solitary spikes. Beyond 100/sec. stimulus frequency the sense organ fails to respond in a one to one manner. In all these cases the magnitude ($2v$) as well as duration of stimulus (0·1 ms.) was kept constant; hence the above effects should be traced to repetitive frequency which is the only variable. From this observation it may be inferred that stimulus frequencies up to 100/sec. fall within the normal functional range of the sense organ.
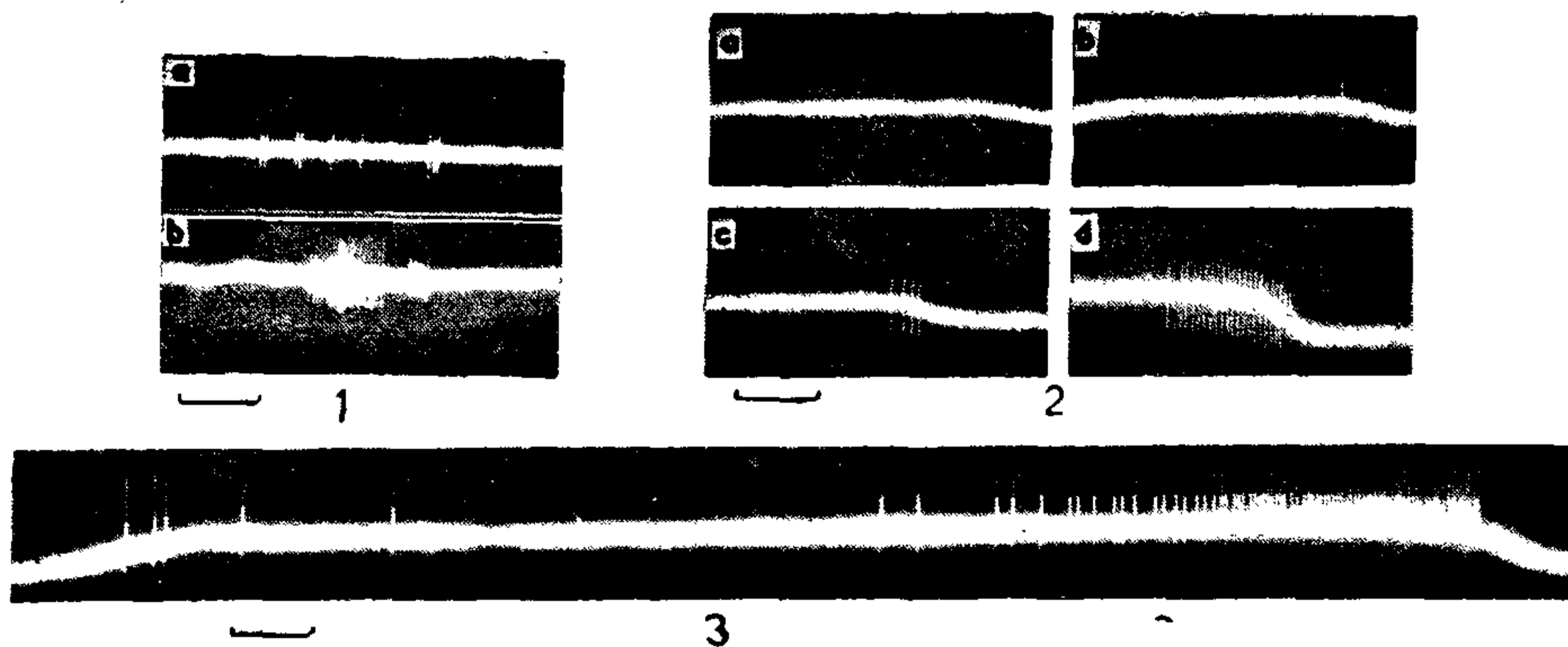
FIGS. 1-3. Fig. 1. Air puff response to (a) slow and (b) fast blowing. Calibration : 200 ms. Fig. 2. Response to mechanical stimulation. In (a) no response can be seen because of subthreshold stimulation. In (b) at threshold stimulation a solitary spike and at increased rates (c and d) more number of spikes are elicited. Calibration : 200 ms. Fig. 3. Response to sustained mechanical stimulation. Note the initial high frequency response, followed by a gradual rate of adaptation and an off response. Calibration : 20 ms.

brought back to its normal position. The typical sensory response (Fig. 3) thus obtained can be dissociated into three phases : the initial and final high frequency zones ; the maintained steady response zone and the low frequency adapting zone. The duration of the off discharge was very brief involving only a few

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