Measurement of the Vestibular Threshold by Means of Electromyography (Preliminary note)

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The results we are presenting in this short preliminary note are based upon experiments in the pigeon. This animal reacts to rotatory stimulation of the semicircular canals with a nystagmus of the head.

The method for electromyographical registration of these movements has been described by one of us (v.Eijck, 1). It has given him the opportunity to demonstrate that rotatory stimulation of the horizontal semicircular canals causes rhythmic contractions of the cervical muscles on the hetero-lateral side of the canal which is stimulated by an ampullopetal endolymph flow {v. Eyck, 2, 3).

The sensitivity of this method induced us to examine in pigeons the threshold for rotatory stimulation of the semicircular canals as we hoped to be able to demonstrate this threshold to be lower than the one observed by Schierbeek (5), who used a subjective method to measure it in the same animal.

For this purpose an apparatus has been constructed (Klijn) along the following lines. An electronic device can give angular accelerations to a turn-table on which a pigeon is mounted.

These accelerations can be varied from .1 to 2.2°/sec.2 during .11 to 1.1 seconds.

For the experiments the non-narcotized pigeon is fixed in Ewald's clog. Its head is immobilized in the position favorable for the maximal stimulation of the horizontal canals. Under a very light ether-narcosis the skin of the occipital region is incised in transverse direction beforehand. This skin is drawn backwards to expose the two muscular masses at the right and left side of the neck.

A pair of needle electrodes is inserted into each muscular mass. The electrical potentials are amplified and visualized on a

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Eyck, Jongkees and Klijn, Measurement

283

cathode ray tube with two channels. The picture is then filmed. The measurement on 10 pigeons did not begin before the animal was wholly awake after the narcosis.

Our first experiments proved that the angular accelerations we had at our disposal were not sufficiently large (in duration or in intensity) to give rise to a visible muscular response of vestibular origin. It might be possible that a slow vestibular adaptation to the gradually progressive stimulation disturbs the results. And though we intend to alter our apparatus! for further

investigations in which we will examine the effect of stronger accelerations, we have continued this series of experiments using short stimulations (“impulses”) in the following way. Between the holder for the pigeon and the turn-table, a friction coupling is placed in such a way that the holder can be kept at a standstill. By releasing the holder the animal is immediately rotated at the speed of the turntable. On the other hand an “impulse” can be given by rotating the animal on the turn-table and stopping it against a buffer. In the first case we could measure the perrotatory nystagmus, in the latter case the measured reaction was postrotatory.

The smallest stimulus found to cause a muscular response has been a sudden stop during a constant rotatory speed of 1.8°/sec.

We feel sure that the burst of registered potentials in these cases was a real response and not an artificial one. It is constantly found on the tracings from the muscles of the side opposite to the canal which is stimulated by an ampullopetal endolymph movement. On the other hand it is evident that the stimulus at this intensity not constantly provokes a muscular answer but only once in two or three stimulations. This is characteristic for stimulations at the threshold. From these experiments it appears that the semicircular canals of the pigeon, in accordance with those in man, are very sensitive for angular stimulation. We hope to be able to give more exact results with a new apparatus, which we are developing now. These results will be described in due time.

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