Electro-olfactograms in man

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Ottoson (1956) demonstrated a slow, negative, monophasic potential from the olfactory region, when this is stimulated by odour-saturated air. This response is analogous to the generator potentials from other sense organs. Ottoson suggested that it should be termed the electro-olfactogram (EOG). Most studies on the EOG have been performed on the frog, because the olfactory region of this animal is easily accessible. The frog is a microsomatic animal. Comparison with macrosomatic animals, i.e. the dog, the rabbit and the guinea-pig, have shown, however, that there is no difference between the EOG on microsomatic and macrosomatic animals (Ottoson, 1959). It has further been demonstrated, that there is no response when the olfactory region is stimulated with pure air, and that the response disappears, if the electrodes are moved to the respiratory region in the nose.

Ottoson found that the response will change when the electrode is moved from one part of the olfactory region to another. The highest potentials are obtained from those parts of the olfactory region where, according to anatomical studies, the sensory cells are particularly numerous. It is also certain that the response is derived from the receptor cells proper, and not from the nerve fibres, as it remains unchanged after blocking with cocaine, which is known from other sense organs to affect nerve fibres and not the sensory cells.

With the use of microelectrodes Ottoson showed that the response becomes smaller when they are moved from the surface to the depth, and he therefore considered the olfactory hairs to be the probable site of origin of the potential.

Within certain limits the amplitude of the response is proportional to the logarithm of the stimulus intensity. This relation is in accord with the properties of the specific epithelium in other sense organs.

Moreover there has been found a difference between the responses to various substances and also to the composition of the mucous covering of the olfactory region.

In our clinic we have attempted for some time to record similar potentials in man. In some preliminary experiments it was quite easy to reproduce Ottoson's findings. In man, however, there are great technical difficulties owing to the hidden anatomical position of the olfactory region and also the fact that manipulations in the nose in order to place the electrode tend to cause fits of sneezing and excessive mucous discharge.

In two persons we succeeded in placing and retaining the electrodes properly for a sufficient length of time to obtain reliable records before mucous discharge prevented further investigations.

For the stimulation we used a modified Elsberg 'blast-injection technique'.

Fig. 1 shows the response to 25 ml. atmospheric air and to 25 ml. coffee-saturated air. The slight response to 25 ml. atmospheric air is presumably

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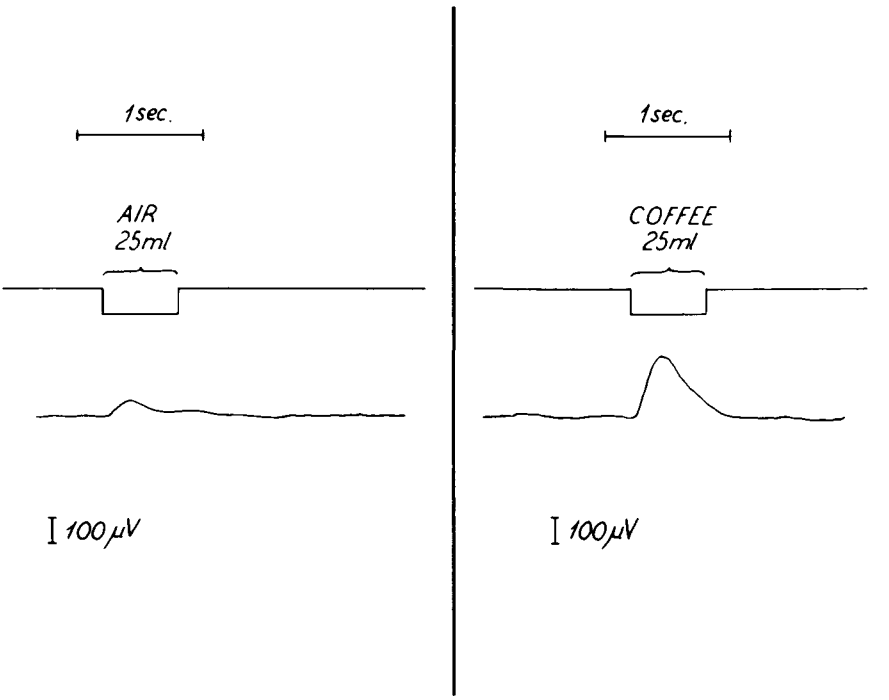


FIG. 1.

Response of the olfactory epithelium after stimulation with 25 ml. atmospheric air and 25 ml. coffee-saturated air.

due to small quantities of odorous substances. It is well known that it is highly difficult to obtain completely odour-free air.

Fig. 2 shows no response to 2 ml. atmospheric air, and definite potentials with 2, 4, and 6 ml. coffee-saturated air. It seems as if the response is proportional to the logarithm of the stimulus intensity.

For the recording we use highly-purified silver wire, 0·5 mm. thick. The end was formed as a knob with a diameter of 1·5 mm. This part was carefully chlorated, while the remainder of the wire was isolated by means of polyethylene tubing 1 mm. in outer diameter. The amplifier was of the differential type, with variable gain, and an input resistance of 10 M ohm, time constant 25 sec. The recorder was a Mingograf 81.

In several other subjects we did not obtain a definite response in spite of seemingly perfect positioning of the electrodes. One patient would appear to be the perfect test object. She had been operated for an ethmoid carcinoma with amongst others exenteration of the orbit, and the anterior part of the turbinates were completely exposed. The sensation of smell was normal on this operated side, and it was easy to place electrodes above the upper turbinate in any desired position. In spite of this, we were unable to obtain any electrical response on stimulation with odorous substances.

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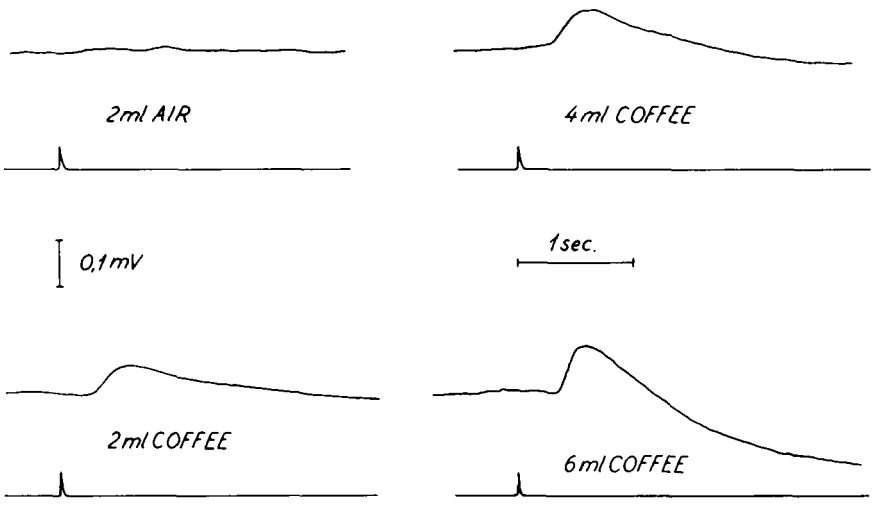


FIG. 2.
Shows no response to 2 ml. atmospheric air, and the potentials after stimulation with 2, 4 and 6 ml. coffee-saturated air.

Summary

Records are presented of electro-olfactograms from two persons. The response appears to be similar to the well known generator potentials for other specific sense organs.

The recording of electro-olfactograms in man is associated with many difficulties, and it is impractical as a clinical procedure.

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