high ambient noise environment. This is an unusual situation as compared to obtaining thresholds of regular audio sound. Our recent experimentation leads us to believe that, if the ambient noise level were not so high, these threshold field strengths would be much lower. Since one purpose of this paper is to suggest experiments, it might be appropriate to theorize as to what the rf sound threshold might be if we assume that the subject is in an anechoic chamber. It is also assumed that there is no transducer noise.

Given: As a threshold for the rf sound, a peak power density of 275 mw/cm² determined in an ambient noise environment of 80 db. Earplugs attenuate the ambient noise 30 db.

If: 1 mw/cm² is set equal to 0 db, then 275 mw/cm² is equal to 24 db.

Then: We can reduce the rf energy 50 db to −26 db as we reduce the noise level energy from 50 db to 0 db. We find that −26 db rf energy is approximately 3 μw/cm².

Thus: In an anechoic room, rf sound could theoretically be induced by a peak power density of 3 μw/cm² measured in free space. Since only 10% of this energy is likely to penetrate the skull, the human auditory system and a table radio may be one order of magnitude apart in sensitivity to rf energy.

RF DETECTOR IN AUDITORY SYSTEM

One possibility that seems to have been ruled out in our experimentation is that of a capacitor-type effect with the tympanic membrane and oval window acting as plates of a capacitor. It would seem possible that these membranes, acting as plates of a capacitor, could be set in motion by rf energy. There are, however, three points of evidence against this possibility. First, when one rotates a capacitor in an rf field, a rather marked change occurs in the capacitor as a function of its orientation in the field. When our subjects rotate or change the positions of their heads in the field, the loudness of the rf sound does not change appreciably. Second, the distance between these membranes is rather small, compared with the wavelengths used. As a third point, we found that one of our subjects who has otosclerosis heard the rf sound.

Another possible location for the detecting mechanism is in the cochlea. We have explored this possibility with nerve-deaf people, but the results are inconclusive due to factors such as tinnitus. We are currently exploring this possibility with animal preparations.

The third likely place for the detection mechanism is the brain. Burr and Mauro (6) presented evidence that indicates that there is an electrostatic field about neurons. Morrow and Sepiel (7) presented evidence that indicates the existence of a magnetic field about neurons. Becker (personal communication) has done some work indicating that there is longitudinal flow of charge carriers in neurons. Thus, it is reasonable to suspect that possibly the electromagnetic field could interact with neuron fields. As yet, evidence of this possibility is inconclusive. The strongest point against it is that we have not found visual effects although we have searched for them. On the other hand, we have obtained other nonauditory effects and have found that the sensitive area for detecting rf sounds is a region over the temporal lobe of the brain. One can shield, with a 2-in.² piece of fly screen, a portion of the stippled area shown in Fig. 6 and completely cut off the rf sound.

Another possibility should also be considered. There is no good reason to assume that there is only one detector site. On the contrary, the work of Jones et al. (8), in which they placed electrodes in the ear and electrically stimulated the subject, is sufficiently relevant to suggest the possibility of more than one detector site. Also, several sensations have been elicited with properly modulated electromagnetic energy. It is doubtful that all of these can be attributed to one detector.

As mentioned earlier, the purpose of this paper is to focus the attention of physiologists on an unusual area and stimulate additional work on which interpretations can be based. Interpretations have been deliberately omitted from this paper since additional data are needed before a clear picture can emerge. It is hoped that the additional exploration will also result in an increase in our knowledge of nervous system functions.

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