LETTER TO THE EDITOR

TO THE EDITOR,

The Journal of Laryngology and Otology.

DEAR SIR,—I shall feel obliged if you will publish an addendum to rectify a description which is faulty owing to an error in the transmission of the MS. of a contribution which I made to the December Number of the *Journal.*

The passage is a reply to the contention that the hair cells cannot be the agents concerned in the generation of electric potential in the vicinity of the cochlea, at a distance from the auditory tract, in response to sound waves, because it is fully developed before there is any potential in the tract, and this is generally considered as the evidence of activity of the cells.

During the arrival of sound waves of the same frequency pressure is periodically raised at the fenestra rotunda, fluid is forced along the scala tympani, and the pressure is raised on the lower surface of the basilar membrane. As these changes are initiated the segment of the membrane, resonating with the frequency, is at its lowest point and subject to maximum tension. The recoil is, therefore, upwards and accelerates the movement of fluid into the corresponding segment of the scala, and provides for its retention. It also forcibly draws the fluid outwards and upwards across the outer wall, accentuating its natural tendency to move in this direction under the influence of centrifugal force. In all segments between it and the fenestra there is also an increase in fluid and in pressure ; but in each of these the membrane offers a resistance which constrains the movement to a circular path, and the recoil is in a downward direction and reverses the movement of the fluid upwards and outwards. Thus in these segments the resistance and the recoil, together, transmit both the increase in fluid and in pressure towards the segment with the resonant membrane.

In general terms the force of the recoil in the resonating segment may be said to be expended in accelerating the movements of the fluid on the opposed surfaces of the membrane in reverse directions, namely, from and to the respective fenestra ; and the momentum which the fluid thus acquires is expended in increasing the displacement and, consequently, the tension of the membrane and the force of the subsequent recoil.

When, however, the first impulse of the series reached the cochlea the recoil was absent. The membrane in consonance with the frequency was not resonating ; it was in the neutral position and offered resistance to displacement directly in proportion to the tension created by it, and the increase in fluid and in pressure were transmitted, to that extent, to those parts of the scala farther from the fenestra in which the resistance to displacement became progressively less.

The mechanism is ideal for concentrating the force generated by a series of waves on the consonant segment of the basilar membrane, and for increasing the concentration during *each phase* of a wave till an optimum result is obtained. But throughout the process the force of the impulses and the consequent total displacement of the membrane, the total distortion of the hair cells, and the total potential created, probably remain substantially constant ; the decrease in the movements of other parts of the membrane compensating for the increase in the consonant segment.

Clearly physiological considerations require that the segment, and only the segment, psychologically associated with the frequency should be displaced sufficiently to excite an impulse in the auditory tract.

The tract potential, or response, would be delayed till the force of the impulses had been sufficiently concentrated on the consonant segment to give this result ; whereas the lesser distortion of the cells in the resonating segment by the initial impulse, augmented by the greater distortion of those in other segments, would generate a potential which would give a cochlear, but not a tract, response.

H. MACNAUGHTON-JONES.