Neuro-Otology: Introduction

The present number of the Bulletin gives clear evidence of the active state of otological research and its present fruitfulness. The unusual difficulty of experimentation on the ear and labyrinth delayed the attack on some otological problems until recent technical advances brought them within the range of examination. The advances during the past twenty-five years in knowledge in this field have been most remarkable, and the pace at present shows no sign of slackening. The present series of papers furnishes an example of the fact that in the study of the ear many disciplines meet. Physiology, physics, pathology, clinical investigation, histology and biochemistry are essential partners in the extension of understanding of these mechanical sense organs, the most highly organized we know. Electronic devices have made a great contribution not only by providing the means to explore the electrical events in nerves and sense organs, but also by providing the tools to measure and produce accurately graded sounds and vibrations and to control rotations used as stimuli. It would be hard to over-estimate the importance of the general adoption of quantitative methods in both laboratory and clinical studies of ear and labyrinth.

During the last quarter-century great changes have taken place in the explanations afforded for many auditory phenomena. It is a hundred years since Helmholtz formulated his theory of hearing, and it has been of enormous value to focus quantitative ideas on to the cochlea. However, the increase of knowledge of the neural processes in the conducting pathway, and detailed examination of mechanical and electrical events in the cochlea, have now made the theory of mechanical resonance of stretched fibres quite untenable as a basis for interpretation of sound analysis by the ear, for with pure tones the highly localized disturbance of the basilar membrane required to restrict stimulation to a few nerve fibres does not in fact occur. Nevertheless, the subjective phenomena of hearing on which Helmholtz based his theory had shown that the cochlea with its neural connexions to the cortex does carry out analysis very like the separation of Fourier components, which can be done by a system of mechanical resonators. It is now clear that this is in part due to properties of neurones in the pathway, with complex interaction occurring in the nuclei between the activity of the primary and secondary neurones. Studies of action potentials in the primary neurones and in the nuclei enable the analytical processes in the cochlea itself, and in the pathway, to be separated; this helps our understanding not only of hearing, but of the transformations that appear common to many sensory pathways within the