ACOUSTICS

Hungarian Meeting

from a Correspondent

THE seventh international congress on acoustics, held at Budapest from August 18 to 26 under the presidency of Professor Tarnöczy of Hungary, was the first occasion on which the meeting had been held in a country of the Eastern block and it is noteworthy that just over 40 per cent of the 1,200 delegates came from these countries. There were also 300 guest members and the size of the gathering emphasizes the growing importance of the subject.

The revived interest in models was evident in the appearance of a few contributions on the subject such as those on the use of a model to evaluate various possible changes to a studio by Dr A. N. Burd (BBC Research Laboratory), and on diffusion and absorption of sound in a model reverberation room by the fathers of modern acoustics, Drs V. O. Knudsen and L. P. Delsasso (University of California, Los Angeles). It is sad to report that Delsasso died suddenly when travelling to the congress.

A balanced selection of topics over the wide field of acoustics had been chosen for the invited fourteen plenary one-hour lecturers. Unfortunately for many listeners nearly half of these were in French or German. Dr J. L. Flanagan (Bell Laboratories, Murray Hill) gave an excellent lecture with demonstrations of advances in selected areas of speech communication. The advances in research in this field are largely due to the expanding and the in-depth understanding of the theory of sampled-data systems and also to the wide adaptability of the moderately sized, fast digital computers. The transmission of speech in digital form, by contrast with analogue transmission, can be made effectively independent of distance as regards quality of reception, and a variety of signals—for example, voice, telegraph and the like—may be interleaved without special consideration. Digital encoding methods for speech are very varied and source coding leading to lower bit rates has resulted in an increased study of speech synthesis. Synthetic speech provides storage economies and vocabulary flexibility which promotes different possibilities in new automatic information services, and every push-button telephone becomes a potential computed terminal. For use in computer answer-back the synthesis of formant data or of printed text both seem attractive. With printed text, the machine stores a pronouncing dictionary which includes a phonemic transcription of each word, word stress and rudimentary syntax information. It generates connected speech solely from a knowledge of the linguistic rules of

the language and the dynamic acoustic properties of the human vocal apparatus.

The frequency range of acoustical investigations has been extended considerably upwards in recent years and, as was mentioned by Dr E. G. S. Paige (Royal Radar Establishment, Malvern), mechanical surface waves can now be generated up to 10 GHz. Mechanical waves of these frequencies (up to 100 GHz) are often termed hypersonic and are being used in physical investigations of the condensed state of matter involving their interaction with electromagnetic, spin and acoustic waves (Dr J. P. Joffrin, University of Paris). At the other extremity of the frequency range (Dr R. W. B. Stephens, Imperial and Chelsea Colleges, London), the wavelength of the sound radiation becomes comparable with the natural frequency of various parts of the human

body, and unpleasant, if not dangerous, effects can arise in consequence. There is a real need for more planned investigations in this frequency region.

The growing field of ultrasonic applications to medicine was made evident by the appearance of several contributions from workers in various countries. Dr J. C. Somer (TNO, Utrecht) described his development of an array of electro-acoustic transducers which comprises twenty-one elements, spaced a half wavelength apart and suitably phased. This technique has been adopted for electronic sector scanning, and provides two-dimensional scanning with a substantially stationary probe. It has particular application to diagnosis of the brain where mechanical scanning has not proved very successful chiefly because of the high absorption of the skull.

Bacterial Purple

NEXT Wednesday's *Nature New Biology* contains a study of the purple membrane found in a species of halophilic bacterium, *Halobacterium halobium*, which shows it to have remarkable resemblance to retinal rods. The cells flourish only at extremely high concentrations of sodium chloride, and towards the end of the logarithmic growth phase there is a rapid accumulation of the purple membrane. Oesterhelt and Stoekenius have found that when the cells are caused to disintegrate by removal of salt, the fragments of the purple membrane are easily separated by centrifugation and washing from other parts of the membrane.

The absorption spectrum of the purple membrane is essentially that of a visual pigment, the maximum in the visible being nearer to that of the cone pigment, iodopsin, than rhodopsin. Denaturation with acid causes bleaching, the purple colour giving way to yellow. The bleached chromophore can be extracted with solvents, and is identifiable as retinal.

In SDS-gel electrophoresis, the dissociated membrane displays only one protein band, with an estimated molecular weight of 26,000. This is also the equivalent of protein found by nitrogen analysis to be present in the membrane for each equivalent of the chromophore. Thus the protein may be supposed to have a molecular weight of 26,000 (supported also by minimum numbers of the sparsely represented amino-acids, for example, one histidine residue corresponding 26,000 molecular weight), which is at the low end of the range of molecular weights at various times offered for rhodopsin. The analogy extends also to the attachment of the retinal to the protein: when reduced after bleaching with borohydride it can

no longer be extracted with solvents, and is evidently therefore attached in the native state by way of a Schiff base linkage to a lysine side chain. Oesterhelt and Stoekenius make the reasonable inference that the purple membrane may be a photoreceptor.

An X-ray diffraction study of the isolated purple membrane fragments by Blaurock and Stoekenius accompanies this characterization. The characteristic spacings for a membrane bilayer, corresponding to two dense layers 40 Å apart, are observed. Furthermore, there are reflexions that show the presence of a large hexagonal lattice, which must therefore be the form of surface packing of the protein molecules. Freeze-fractured specimens of whole cells show in the electron microscope evidence of a regular lattice on patches of the membrane (it being assumed that the cleavage plane is in the bilayer). Because these increase in number towards the end of logarithmic growth, it seems that they correspond to the purple areas. Light-diffraction patterns are also consistent with a hexagonal array.

From measurements of partial specific volume, Blaurock and Stoekenius have calculated that the unit cell in the purple membrane preparations contains some forty molecules of lipid and three or four molecules of protein. Because hexagonal packing in a plane demands that the unit cell contain three units, Blaurock and Stoekenius suggest that the protein is disposed in two layers rather than one. The visible absorption band of the chromophore shows strong dichroism, the long axis of the retinene lying in the plane of the membrane, exactly as found in retinal rods. This seems to be the first example of the existence of specialized functional areas in cell membranes.