

demands, be applied so that the load on the fibres is small near the base, but large near the apex.

A great difficulty in supposing that the basilar membrane represents a system of resonating strings is the fact that it is immersed in fluid. It is precisely this point which Dr. George Wilkinson, in a paper read before the Section of Physiology of the British Association at the recent Hull meeting, conceives to be, not a difficulty, but the key of the whole problem. He suggests that the differentiation of the fibres as to mass, or the "loading" of the fibres, is brought about by the fluid in the canals. When the fibres at any point of the membrane vibrate in response to an impulse from the middle ear, they will be loaded by the weight of a column of fluid proportional to the distance of the vibrating point from the *fenestra rotunda*, which is the window between the cochlea and the middle ear. The column of fluid between the window and the vibrating point will be least in the case of a point on the membrane near the base of the cochlea, and greatest in the case of a point near the apex.

So much for Dr. Wilkinson's theoretical conception. He has provided a convincing proof of his views in the shape of two very ingenious models. The first is a brass box divided horizontally into two like the cochlea unwound from its spiral. The partition which represents the basilar membrane consists of a series of parallel wires of phosphor-bronze soldered firmly in position, and covered with formalised gelatin. On this basilar membrane is scattered blue enamel powder. There is a *fenestra rotunda* and *ovalis* at one end of the box, respectively above and below the basilar membrane, the windows being formed in each case by a rubber disc. The box is filled with water and is completely closed. In his first model, Dr. Wilkinson has kept all his phosphor-bronze wires at the same tension and of the same

length. Yet he finds that when he applies a vibrating tuning-fork to the rubber membrane, or *fenestra rotunda*, the powder on the basilar membrane takes up a definite position which varies with tuning-forks of different rates of vibration. Thus a 200 D.V. fork produces a localised resonant response at a distance 3.3 cm. from the proximal end of the scale, while a 400 D.V. fork produces such a response at a distance of 0.9 cm. If one makes use of the formula for vibrating strings and supposes that the differentiation in resonance is due to the different loading of the wires by the fluid according to the above hypothesis, then the point of resonance to the lower tone should be 4 times the distance from the windows compared with that for the upper tone. Actually we see that it is not 4 times, but is $3.3/0.9 = 3.6$ times. A very striking agreement!

Here then is proof of Dr. Wilkinson's contention that a system of transverse fibres, immersed in a fluid as it is in the cochlea, is already, by reason of the position of the *fenestra*, differentiated for resonance in regard to the effective mass of the fibres.

In his second model, which is larger, he has carried out a differentiation of his phosphor-bronze wires in respect of tension and length. The differentiation of tension is effected by attaching weights of different sizes to the ends of the individual wires; while the lighter weights are attached to the longer fibres near the "apex," the heavier weights are attached to the shorter fibres near the base. In this way he has attained a model which gives a localised resonant response over a range exceeding four octaves.

One may say in conclusion that Dr. Wilkinson has made a very considerable contribution to our knowledge of the mechanism of hearing, and has presented the first clear conception of how the cochlea can work.

British Association Research Committees.

RESEARCH committees to deal with the following subjects were appointed by the General Committee at the recent meeting of the British Association at Hull. The names given are those of the chairmen and secretaries of the committees.

SECTION A (MATHEMATICS AND PHYSICS).—Seismological investigations: Prof. H. H. Turner, Mr. J. J. Shaw. To assist work on the tides: Prof. H. Lamb, Dr. A. T. Doodson. Annual tables of constants and numerical data, chemical, physical, and technological: Sir Ernest Rutherford, Prof. A. W. Porter. Calculation of mathematical tables: Prof. J. W. Nicholson, Dr. J. R. Airey. Determination of gravity at sea: Prof. A. E. H. Love, Prof. W. G. Duffield. Investigation of the upper atmosphere: Sir Napier Shaw, Mr. C. J. P. Cave. To aid the work of establishing a solar observatory in Australia: Prof. H. H. Turner, Prof. W. G. Duffield.

SECTION B (CHEMISTRY).—Colloid chemistry and its industrial applications: Prof. F. G. Donnan, Dr. W. Clayton. Absorption spectra and chemical constitution of organic compounds: Prof. I. M. Heilbron, Prof. E. C. C. Baly.

SECTION C (GEOLOGY).—The Old Red Sandstone rocks of Kiltorcan, Ireland: Prof. Grenville Cole, Prof. T. Johnson. To excavate critical sections in the palaeozoic rocks of England and Wales: Prof. W. W. Watts, Prof. W. G. Fearnside. The collection, preservation, and systematic registration of photographs of geological interest: Prof. E. J. Garwood, Prof. S. H. Reynolds. To consider the preparation of a list of characteristic fossils: Prof. P. F. Kendall, Mr. H. C. Versey. To investigate the flora of lower

carboniferous times as exemplified at a newly discovered locality at Gullane, Haddingtonshire: Dr. R. Kidston, Prof. W. T. Gordon. To investigate the stratigraphical sequence and palaeontology of the Old Red Sandstone of the Bristol district: Mr. H. Bolton, Mr. F. S. Wallis.

SECTION D (ZOOLOGY).—To aid competent investigators selected by the committee to carry on definite pieces of work at the Zoological Station at Naples: Prof. E. S. Goodrich, Prof. J. H. Ashworth. To summon meetings in London or elsewhere for the consideration of matters affecting the interests of zoology, and to obtain by correspondence the opinion of zoologists on matters of a similar kind, with power to raise by subscription from each zoologist a sum of money for defraying current expenses of the organisation: Prof. S. J. Hickson, Dr. W. M. Tattersall. Zoological bibliography and publication: Prof. E. B. Poulton, Dr. F. A. Bather. Parthenogenesis: Prof. A. Meek, Mr. A. D. Peacock. To nominate competent naturalists to perform definite pieces of work at the Marine Laboratory, Plymouth: Prof. A. Dendy (*Chairman and Secretary*). Experiments in inheritance in silkworms: Prof. W. Bateson, Mrs. Merritt Hawkes. Experiments in inheritance of colour in Lepidoptera: Prof. W. Bateson (*Chairman and Secretary*).

SECTION E (GEOGRAPHY).—To consider the advisability of making a provisional population map of the British Isles, and to make recommendations as to the method of construction and reproduction: Mr. H. O. Beckit, Mr. F. Debenham.

SECTIONS E; L (GEOGRAPHY, EDUCATION).—To

formulate suggestions for a syllabus for the teaching of geography both to matriculation standard and in advanced courses; to report upon the present position of the geographical training of teachers, and to make recommendations thereon; and to report, as occasion arises, to Council, through the Organising Committee of Section E, upon the practical working of regulations issued by the Board of Education affecting the position of geography in training colleges and secondary schools: Prof. T. P. Nunn, Mr. W. H. Barker.

SECTION G (ENGINEERING).—To report on certain of the more complex stress distributions in engineering materials: Prof. E. G. Coker (*Chairman*), Prof. L. N. G. Filon, and Prof. A. Robertson (*Secretaries*).

SECTION H (ANTHROPOLOGY).—To report on the distribution of Bronze Age implements: Prof. J. L. Myres, Mr. H. J. E. Peake. To conduct archaeological investigations in Malta: Prof. J. L. Myres, Sir Arthur Keith. To conduct explorations with the object of ascertaining the age of Stone Circles: Sir Hercules Read, Mr. H. Balfour. To excavate early sites in Macedonia: Sir William Ridgeway, Mr. S. Casson. To report on the classification and distribution of rude stone monuments: Dr. R. R. Marett, Prof. H. J. Fleure. The collection, preservation, and systematic registration of photographs of anthropological interest: Sir Hercules Read, Mr. E. N. Fallaize. To conduct archaeological and ethnological researches in Crete: Dr. D. G. Hogarth, Prof. J. L. Myres. To co-operate with local committees in excavation on Roman sites in Britain: Sir William Ridgeway, Mr. H. J. E. Peake. To report on the present state of knowledge of the ethnography and anthropology of the Near and Middle East: Dr. A. C. Haddon, Mr. E. N. Fallaize. To report on the present state of knowledge of the relation of early palæolithic implements to glacial deposits: Mr. H. J. E. Peake, Mr. E. N. Fallaize. To investigate the lake villages in the neighbourhood of Glastonbury in connexion with a committee of the Somerset Archaeological and Natural History Society: Sir William Boyd Dawkins, Mr. Willoughby Gardner. To co-operate with a committee of the Royal Anthropological Institute in the exploration of caves in the Derbyshire district: Sir William Boyd Dawkins, Mr. G. A. Garfitt. To investigate processes of growth in children, with the view of discovering differences due to race and sex, and further to study racial differences in women: Sir Arthur Keith, Prof. H. J. Fleure. To conduct excavations and prepare a survey of the Coldrum megalithic monument: Sir Arthur Keith, Prof. H. J. Fleure. To report on the existence and distribution of long-barrows in the Isle of Man: Prof. H. J. Fleure, Dr. Cyril Fox. To report on proposals for an anthropological and archaeological bibliography, with power to co-operate with other bodies: Dr. A. C. Haddon, Mr. E. N. Fallaize. To report on the best means of publishing a monograph by Dr. Fox on the archaeology of the Cambridge region: Dr. A. C. Haddon, Mr. H. J. E. Peake.

SECTION I (PHYSIOLOGY).—Efficiency of movement in men equipped with artificial limbs: Prof. E. P. Cathcart, Prof. A. V. Hill. Muscular stiffness in relation to respiration: Prof. A. V. Hill, Dr. Ff. Roberts.

SECTION J (PSYCHOLOGY).—The place of psychology in the medical curriculum: Prof. G. Robertson, Dr. W. Brown. Vocational tests: Dr. C. S. Myers, Dr. G. H. Miles.

SECTION K (BOTANY).—To continue breeding experiments on *Oenothera* and other genera: Dr. A. B. Rendle, Dr. R. R. Gates. Primary botanical survey in Wales: Dr. E. N. Miles Thomas, Prof. O. V. Darbishire.

SECTION L (EDUCATIONAL SCIENCE).—Training in

citizenship: Rt. Rev. J. E. C. Welldon, Lady Shaw. To inquire into the practicability of an international auxiliary language: Dr. H. Foster Morley, Dr. E. H. Tripp.

University and Educational Intelligence.

BIRMINGHAM.—The University War Memorial, which was unveiled on Sunday, October 8, takes the form of three large panels of marble, on the eastern side of the entrance hall of the University, bearing the names of members of the University who fell in the war.

The Muirhead lectures in social philosophy are to be delivered by Prof. J. H. Muirhead, who has chosen as his subject "The Idea of Progress." The first of the series of seven is to be given on October 16. The lectures are free.

CAMBRIDGE.—The Vice-Chancellor announces a legacy of 1000*l.*, free of legacy duty, to the Agricultural Department of the University by the will of the late Charles Jewell; by the will of the late Dr. Rivers books and pamphlets have been left to the library of St. John's College, and in addition 70 volumes have been selected for the library of the Psychological Department and 295 volumes for that of the Department of Ethnology.

Mr. W. J. H. Sprott, Clare College, has been appointed demonstrator in experimental psychology.

Mr. J. C. Burkill and Mr. A. E. Ingham have been elected Fellows of Trinity College.

It is proposed to confer an honorary M.A. degree on Prof. H. R. Dean.

LEEDS.—At a Congregation of the University held on Tuesday, October 10, the Duke of Devonshire, Chancellor of the University, presiding, the following honorary degrees were conferred: *Litt.D.*: The Lord Bishop of Ripon (The Rt. Rev. Dr. Thomas Banks Strong) and Mr. Bruce Richmond, Editor of the *Times Literary Supplement*. *D.Sc.*: Sir Dugald Clerk, Sir Frank Dyson, Astronomer Royal, and Sir Richard Gregory, Editor of *Nature*, president of the Educational Section of the British Association, 1922. *LL.D.*: Mr. H. I. Bowring, Mr. B. Broadbent, Mr. H. McLaren, and Mr. C. F. Tetley.

Sir Dugald Clerk was presented by Prof. Smithells, who said, "In him we welcome one who came to Leeds as a member of the first chemical staff of the Yorkshire College of Science, and he returns to-day a man eminent among his fellows as a great example of the ideal on which this University has spent so much of its early labours—the harmonious and fruitful union of pure and applied science."

In presenting Sir Frank Dyson, Prof. Whiddington referred to him as "the most distinguished British astronomer," who, they remembered with pride, is also a great Yorkshireman, and in his chosen field of work has been unvaryingly successful. "Every one knows him as the Astronomer Royal, a position which in these days of astronomical discovery he has filled with the highest distinction."

Prof. Smithells, in presenting Sir Richard Gregory, said: "He stands as one of the most distinguished of those who strive to interpret science to the multitude, to obliterate the false antagonisms that have arisen between the different realms of knowledge, and to win for science her rightful place among the potent influences that act for the true enlightenment and progress of mankind."

LONDON.—Dr. C. Da Fano will begin on Wednesday, October 25, at King's College, at 4.30, a course of eight free public lectures on "The Histology of the