Gramophone Records of Acoustic Analyses.

AT a meeting of the Physical Society of Sheffield held at the University of Sheffield on Feb. 11, a number of special gramophone records prepared in the Bell Telephone Laboratories, New York, to illustrate certain phenomena of hearing, were demonstrated by Dr. W. H. George. In the preparation of the original records the usual electrical process was used to convert the sound-waves by means of a microphone and amplifier into fluctuating electrical currents which, in passing through an electromagnetic recorder, operate the stylus cutting the 'wax'. In addition, electric filters could be switched into the circuit so as to eliminate effectively known frequency ranges.

Three of the records demonstrate the striking discovery of Fletcher (*Phys. Rev.*, **23**, p. 427; 1924) that, contrary to the usual conception, the pitch of a musical sound is *not* necessarily that of the lowest component vibration. A single note (C = 256 vib. per sec.) is played successively upon a piano, a 'cello, and a French horn, and then the notes are repeated with the filters adjusted to eliminate the fundamental tone, then the fundamental and the first two overtones, and later all below the sixth or eleventh overtones. Although great differences in quality and intensity are apparent, the pitch of the notes heard remains the same. Quality differences sometimes make it difficult to decide if the pitch is middle C or one of its octaves. The experiments and results are repeated with the sung vowel Ah, with an organ pipe and with a clarinet, in which latter instrument the lower even overtones are very weak.

Low pass filters are used in another record to illustrate the effect on tone quality of removing the upper partials from the tones of a single note played upon a piano, 'cello, or French horn. The filters are adjusted to give successively the fundamental, and then no overtones above the first, fourth, ninth, and seventeenth. Notable changes of quality and loudness are observed depending upon the relative intensity of the various overtones for each instrument. When the fundamental only is recorded the instruments are almost indistinguishable, but the slight difference which remains when allowance has been made for the intensity differences and for a certain difficulty of the horn player getting the correct note, suggests that the quality of a musical note depends also upon the rate of growth and decay, and it would be interesting to hear the effect of various amplitude changes imposed upon a tone which when sustained was pure and of single frequency.

The remaining records deal with the quality changes produced in much more complex sounds consisting of a short musical passage played by a number of instruments and with a passage spoken by the normal voice. The original sounds cover a normal range of frequencies, and the filters introduced pass only the frequency ranges 375-2500 or 750-1250, below 1250 or 2500 or above 375 or 1250 vibrations per second. The effects of an overloaded amplifier with and without a middle pass filter are illustrated and the characteristic high hissing sound appears well in the spoken passage. Filters are not used in two of the records which demonstrate the effects of reductions in the general intensity of the same complex sounds. The intensity level is lower by steps of 1, 3, 5, 10, 20, and 30 transmission units (or decibels). Incidentally, these two records enable the hearer to obtain an idea of the scale of this unit which is being generally adopted.

Apart from the general interest of the records, it would appear that, provided we regard a good gramophone as fairly common, then the three records illustrating Fletcher's work on perception of pitch form the first example of a research worker in acoustics presenting results originally obtained with complex and expensive apparatus in such a form that the actual phenomena involved can be experienced by others not so equipped. The records may then be regarded as the analogues of the spectrum or X-ray photographs presented in papers dealing with other branches of physics.

Common Commercial Timbers of India and their Uses.

THE technical publications of research institutes have rarely much attraction for the layman, nor are they commonly read by members of trades to whom they would prove useful. With this truism in mind, Mr. H. Trotter, forest economist at the Forest Research Institute at Dehra Dun, has recently prepared a brochure entitled "The Common Commercial Timbers of India and their Uses" (Calcutta: Government of India Central Publication Branch, 1929), designed for the use of timber merchants and other users of Indian timbers.

This booklet is based, as the author admits, on one drawn up in 1912 by his predecessor, Mr. R. S. Pearson, entitled "A Commercial Guide to the Forest Products of India". Mr. Trotter's work shows the great advance in knowledge in these matters which has been made since 1912. In the preface the author states: "A great deal has been written of late years concerning the 'vast forest wealth' of India. The fact remains, however, that except for teak and a few parcels of other timbers from Burma, Madras, and the Andamans, there is practically no export of timber from the country. In the same way, the Indian markets concentrate on teak, sal, deodar and a few other well-known woods, while local craftsmen content themselves with the cheapest timber available, whether suitable for the purpose for which it is intended or not."

Two factors are bringing about a change in the conservative ideas which have so long persisted throughout India. The first is the prohibitive prices to which the more commonly used valuable timbers have risen; the second, the valuable work carried out at the Research Institute during the past eighteen years. As is obvious from his work, Mr. Trotter regards the forest wealth of India from the purely timber point of view. Writers with perhaps a wider experience when alluding to the "vast forest wealth" of the country have not been so limited. If some of the most valuable timbers of the country were eliminated from the account, the value of India's forest wealth, regarded from the point of view of the requirements of the greater bulk of its population, would still be enormous; and to this may be added an increasing number of minor products of the forest the potential value of which is at present not computable.

The author divides his work into several chapters, dealing with the storage of logs in log ponds (the method being described and illustrated); air-seasoning—a section which will well repay careful study—kiln-seasoning; preservation of timber by impregnation, and a chapter describing various common Indian woods. This latter chapter is of importance, since, from the experience gained at Dehra Dun, it has proved possible to modify some of the descriptions

in old text-books of Indian timbers, for example, Gamble's "Manual of Indian Timbers".

The practical user of timber, as also the forest officer, will probably find Chap. vi., "Woods recommended for Special Uses", of the highest interest. It is certain that this chapter best illustrates the remarkable progress in our knowledge in these respects which has resulted from the work of the research institute at Dehra Dun. The author points out that there is a wide range between the cork-like wood of *Erythrina* and the iron-like hardness of 'pyinkado', and that only research and trial will enable each timber to be allotted to its best purpose; this is the work the economic side of the Institute has been engaged upon. "As the work of research proceeds, it becomes more and more evident that India possesses timbers which are unsurpassed by any other country, but the practical utilisation of the lesser known timbers has been hindered by a curious circumstance. This circumstance can be summed up in the one word 'teak'. For years past, teak has been the watchword in India. It is what one might call a fool-proof wood, and its durability and adaptability soon made it famous throughout the world. With such a timber available in good quantities, Indian users looked no further for possible substitutes, until the inevitable began to happen, and supplies became more restricted, resulting in a very rapid rise of price. Then, at last, India began to look to the rest of her timbers, and although considerable progress has been made to date, it will be some years yet before she knows exactly what her resources in this direction are, and still more time will be required before the industrial world is satisfied that these other timbers will answer the purpose for which they are required. In addition to teak, such timbers as sal (*Shorea robusta*), deodar, chir (*Pinus longifolia*), sissoo (*Dalbergia sissoo*), and a few others, were used fairly extensively in those parts where they occurred, but beyond these, the commercial exploitation of the many hundreds of other so-called Indian 'junglewoods' was a thing unknown."

The author divides this section into constructional woods, woods used in contact with the ground, woods used in contact with water, in boat- and ship-building (the best Burma teak known as 'Admiralty Teak' still reigns supreme), joinery and cabinet-making (a number of species are enumerated); cart- and carriage-making; cooperage, packing cases, and various miscellaneous articles. A perusal of this chapter renders it evident that India could, and probably will, become entirely self-supporting in articles the raw material of which is timber, and that in the future the people will be weaned from the old ideas which confined utilisation to teak, sal, deodar, and one or two others; for this chapter shows that already a variety of other Indian timbers are being brought into use.

Mr. Trotter is to be congratulated on a very valuable and useful piece of practical work which, *du reste*, is suitably illustrated.

Larval Crabs.

AN important addition to our knowledge of development in the Brachyura is contained in Hiroaki Aikawa's recent work "On Larval Forms of some Brachyura" (*Records of Oceanographical Works in Japan*, vol. 2, No. 1; 1929). The author has hatched out the young of twenty-four species of Japanese crabs, and from these first zoeas each genus can be quite easily recognised.

Previous writers have used mainly the form of telson, presence or absence of spines on carapace, and the antennæ, as diagnostic characters of crab zoeæ, and those hitherto known can be classified by such characters, together with a knowledge of the number of zoeal stages. The present author gives prominence also to the chromatophores, giving them a foremost place. There is no doubt that these chromatophores are of importance; the disadvantage in using them is their comparatively fleeting nature. Although Mr. Aikawa states that the primary chromatophores (which alone are used) remain for a long time in preserved material, they undoubtedly do disappear eventually. Taken together with the other characters, however, they are of considerable value.

The system of classification given, based on the first zoeas only, is good, and shows that the Japanese crabs studied fit well into the usual scheme of classification. It is to be hoped that further study will be made of the later stages and megalopæ. A knowledge of these, together with number of zoeal stages, is much wanted. The Oxyrhyncha having been shown in all known forms (with a few doubtful exceptions) to have only two zoeal stages, necessarily develop much more quickly than the Brachyrhyncha, and even in the first zoea this difference can be seen.

The crabs described belong to various groups and families, most of the larvæ being described for the first time, and the first zoea is in many cases compared with those from other countries, fitting in well with previous observations. If such a study were to be made in all parts of the world, we should have a real foundation on which to work in order to form a scheme of classification which would undoubtedly help the systematist, for no systematic work can be complete without the thorough knowledge of all larval stages. The paper is very well illustrated and is a welcome contribution to the literature on crustacean larvæ.

University and Educational Intelligence.

BIRMINGHAM.—Dr. J. G. Emanuel is to be invited to fill the vacancy in the joint professorship of medicine from the beginning of the summer term 1930.

The following gifts have been received: £350 from the Distillers Company, Ltd., for a post-graduate research investigation in oil engineering; £100 from the Anglo-Persian Oil Company and £100 from the Institute of Automobile Engineers, for research in oil engineering; mine rescue apparatus to the value of £210, from Messrs. Siebe, Gorman and Co.; and a collection of modern safety lamps, to the approximate value of £77, from several firms, for the Mining Department. Mrs. Frankland has presented to the Chemistry Department a bronze relief portrait of Prof. P. F. Frankland, first professor of chemistry in the University.

The following resignations have been received: Mr. T. H. Turner (lecturer in metallurgy), Mr. L. P. Timmins (oil engineering), and Dr. W. C. O. Hill (anatomy). An additional assistant lecturer (Grade III.) is to be appointed in the Department of Geography.

EDINBURGH.—The Court has agreed to subscribe to the Students' Hostel at Benmore, Argyllshire. This Hostel, which was formerly the Mansion House of Benmore, has been presented to the Forestry Commission (Scotland) by Mr. Harry Younger, who had previously given the whole estate to the Commission. The house will be open to visiting students and members of scientific societies interested in sylviculture and botany from April 1 to Sept. 30 in each year. The policies, extending to 115 acres, including the gardens and arboretum, will be open to authorised visitors. In addition, the adjoining and neighbouring estates