

reticularis, and strike against the under surface of the membrana tectoria. A reaction would take place from the latter, and thus the delicate nerve-endings between the hair-cells would receive pressures corresponding in frequency to the oscillations of the membrana basilaris. In the cochlea of birds and amphibia, the mechanism is practically the same, but in consequence of the membrana basilaris not being highly differentiated, there cannot be the nice discrimination of pitch of tone which exists in the higher animals. The lecturer gave reasons for holding that a bird has a power of discriminating pitch only through a narrow range. These views were also, on the whole, supported by pathological observations in cases of deafness, and of the deafness of boiler-makers in particular. In the latter there is the loss of perception of high tones, and degenerations are observed in the lower whorl of the cochlea, as is required by theory. The action of the cochlea, as thus conceived, was demonstrated with a model. The lecturer also gave a large number of measurements of parts of the ear, showing that there were a sufficient number of structures in the cochlea to enable us to detect differences of the $1/64$ th of a semitone, thus amplifying the conclusions reached long ago by Helmholtz. The number of nerve-fibres in each cochlear division of the auditory nerve is about 14,000, giving something like 1250 for each octave through the eleven octaves of audibility. Assuming that the number of auditory filaments is the same for each of the eleven octaves (an unlikely supposition, as there will probably be a larger number of filaments for octaves in the middle of the range of the ear), there will still be two filaments for each $1/64$ th of a semitone; while, for the same interval, there will be three fibres of the membrana basilaris, and two hair-cells. The production of combination tones, differential and summational, was next considered, the lecturer stating that, in his opinion, and founded on experiment, both had an objective existence. They are not beats, but true sounds superadded to the generators, and thus they fall within the scope of Ohm's law. The theories, other than that of Helmholtz, were then criticised; namely, those of Rutherford, Waller, Hurst, and the more recent one of Max Mayer. The most obvious objection to any theory which dispenses with peripheral analysis is that it leaves the exceedingly elaborate structure of the organ of Corti, and indeed of the cochlea, as a whole, out of account; or, to put the matter in another light, it assigns to that organ a comparatively simple function. Ohm's law also may be subject to certain limitations, but there is no substitute for it. Max Mayer agrees with Hurst in imagining a series of waves transmitted along the scalæ, instead of the scalæ forming part of one wave. The two differ in respect that Max Mayer supposes, on physical grounds, that the amplitude must diminish from base to apex of the cochlea; while Hurst argues, also from the physical point of view, that the amplitude must increase. This is a serious discrepancy, inasmuch as Mayer's theory rests wholly on the supposition of diminished amplitude. It seems impossible to conceive of minute waves following each other in rapid succession in the minute tubes forming the scalæ. These theories are independent of the principle of sympathetic resonance, imperishably associated with the name of Helmholtz, and which still, in the lecturer's opinion, holds the field. Lastly, the lecturer pointed out that the roots of the auditory nerves were probably more widely distributed and had more extensive connections than those of any other nerve. The intricate connections of these nerves were only being unravelled. This pointed to an explanation of how music penetrates to the very roots of our being, influencing by associational paths, reflex mechanisms, both cerebral and somatic, so that there was scarcely a function of the body that might not be affected by the rhythmic pulsations, melodic progressions, and harmonic combinations of musical tones.

THE DARMSTADT MUSEUM.

THROUGHOUT the civilised world attention is being concentrated on the improvements in the mode of arranging specimens in the exhibition galleries of natural history museums; so that they should be both attractive and instructive to the general public, and at the same time useful to the student. Nowhere does this advance seem more marked than at Darmstadt, where the Director, Dr. G. von Koch, has just published an interesting and well illustrated progress report ("Die Aufstellung der Tiere im neuen Museum zu Darmstadt," Leipzig, 1899.)

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We gather from this report that a large proportion of the museum is devoted to the systematic classification of animals; and it is gratifying to observe that not only are skeletons and skulls ranged side by side with the mounted skins, but that anatomical preparations and remains of extinct forms are introduced in their proper serial position. A notable feature (in the seventh gallery) is the exhibition of a series of economic animal products, such as furs, wool, leather, ivory, tortoise-shell, mother-of-pearl, shell, coral, &c. But the greatest novelty is the formation of a gallery (the eighth in the series) illustrating the geographical distribution of animals on the globe. And here, instead of arranging the specimens on the conventional wooden stands on tier upon tier of shelves, an attempt has been made to reproduce the natural surroundings of their habitat.

To take, for example, the South and Central American region, we find, as shown by one of the plates accompanying the report, alligators, tapirs, carpinchos, chajas, &c., occupying the low land by the river. In the adjacent forest tract we have anteaters, sloths, coatis, pacas, opossums, armadillos and the characteristic monkeys. On a higher level we have the open pampas and llanos, with peccaries, brockets, pumas and rheas; while the background of the scene is formed by mountain peaks tenanted by guanacos, vicuñas and condors. Birds of other kinds are likewise introduced in appropriate positions so far as the limits of space permit. Similar scenes represent the other great zoo-geographical regions; and it is important to notice that the whole series is ushered in by the fauna of Hessen-Darmstadt itself.

It would undoubtedly add much to the interest and instructiveness of our own natural history museums if arrangements could be made for the formation of galleries of economic and distributional zoology on somewhat similar lines.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—A number of the foreign guests who had been present at the Stokes jubilee celebration and the Royal Institution centenary were invited to Oxford on the 8th, and were entertained at a luncheon in Christ Church. Among those who came were Profs. Arrhenius, Barker, Barus, Becquerel, Bleekrode, Ciamician, Cornu, Deslandres, Franchimont, Egoroff, Gautier, Körner, Le Chatelier, Liebreich, Martius, Michelson, Moissan, Nasini, Newcomb, and Sivebright.

In a convocation held the same day, the honorary degree of D.C.L. was conferred upon Profs. Becquerel, Körner, Liebreich, Moissan and Newcomb.

The following were the speeches made by the Regius Professor of Civil Law, Dr. H. Goudy, in presenting them.

Nihil pulchrius nobisque optatius est quam viros e gentibus externis de scientiarum studiis optime meritos societati nostrae adscribi atque artissimo et dignitatis et amicitiae nobiscum vinculo consociari. Quae res hodie Universitati nostrae contigit quae eos viros, quos mihi adstare videtis, communi omnium ejus membrorum consensu (Instituto quod dicitur Regii annum centenarium feliciter actum commemorans) insigniri jussit.

BECQUEREL.

Primum ad vos duco virum illustrem, Gallica stirpe oriundum, qui in scientia physicae famam eximiam est adeptus, patris in eadem scientia illustris filium. Physicae studiosorum in manibus sunt scripta ejus praeclara principii scientiae illius illustrandis destinata. Operum numerum quorum auctor doctus ille existit referre longum est; neque tamen, ut plurima praeteram, silentio praeterenda videntur opuscula illa, publici juris facta, in quibus de magnetis et electri proprietatibus felicissime disseruit, ipsamque Naturam, rerum creatricem, in lucem proferre coegit quam ratione quaedam corpora aliquando lumina emittant atque vires electricas eis transmissas per longum tempus retinere possint.

KÖRNER.

Praesento vobis virum egregium, Germanica stirpe oriundum, inter eos qui praecipuum curam rebus chemicis dederunt notissimum. Quantum in ea parte Naturae profecerit, quam multa ingeniose et subtiliter excogitaverit, mihi exponere minime concedit sermonis academici egestas! Quid de compositis aromaticis ab eo recte libratiss, quid de *ισομορία*, ut Graeco utar vocabulo, corporum in conjunctione naturali disseram?