

RESEARCH ITEMS

Origin of the Pentatonic Scale

THE late survival of a manner of life belonging to the Early Iron Age in the Hebrides has suggested to E. Cecil Curwen a study of the origin of and distribution of the pentatonic scale (*Antiquity*, December 1940) which occurs there in folk-song as, it was supposed, a unique instance in Europe. An examination of various collections of folk-songs showed that the scale of five notes occurred as a tradition strong in Scotland, fairly strong in Ireland, but weak in Wales and England. The scale of six notes (hexatonic), however, is almost as strong in England and Wales as in Scotland and Ireland. Western Europe (Brittany, France, Basque) is weak in pentatonic but still strongly hexatonic. In northern Europe there is a heavy concentration of pentatonics in the extreme north (Lapland), fringed by a moderately strong pentatonic tradition in Finland, the Faroes, and perhaps northern Russia. Farther south, pentatonics are weak, hexatonics numerous, except, possibly, in Germany. Fewer melodies have been acquired in southern Europe. Pentatonics seem to be confined to Greece and the Balkans, hexatonics here, too, being numerous, but weak elsewhere where the heptatonic scale prevails. Outside Europe the tradition is: Arab, highly developed heptatonic; India, heptatonic with an earlier pentatonic co-existing, and associated with a pre-Aryan population; Persia, resembling Hindu. This suggests a possible correlation between heptatonic scales and Indo-European languages. Elsewhere in Asia, pentatonic scales are common if not predominant—Mongolia, China, Japan, Siam, Annam, Java, also South Seas, New Guinea. In America and Africa, pentatonics are common or have been widely reported. This distribution suggests that the area covered by the Indo-European languages forms an island of heptatonics surrounded by an ocean of earlier pentatonics. The latter is vocal rather than instrumental, while the heptatonic is an instrumental scale and its distribution is a measure of the spread of harp, lyre or flute. These are considered to be of Asiatic origin, the harp appearing so early as the close of the fourth millennium B.C. (Jemdet Nasr). The heptatonic scale is therefore one of the arts of material civilization appearing with agriculture. In the process of diffusion from the East, it probably reached Great Britain in the Late Bronze Age with the Celtic intrusion, where it impinged upon a population descended from the neolithic megalith builders who had spread along the shores of the Atlantic and formed a pre-Celtic pre-hexatonic population, possibly to be identified with the Picts.

Social Organization of the Haisla, British Columbia

THE Haisla, who occupy the upper reaches of the Douglas Channel, with Tsimshian, Kemano-Kitlope and Haihais as their nearest neighbours in the maze of channels east of Princess Royal Island, were visited in 1935 by an expedition under the auspices of the University of California with the assistance of the Social Research Council. Ronald L. Olson, in reporting on their social organization (*Univ. Cali-*

fornia Anthropol. Rec., 2, 5; 1940), appends notes dealing with the Kitlope (Kemano) tribe. The Haisla and Kitlope alone of the Kwakiutl-speaking tribes have a full-fledged maternal exogamic class organization. They say that the Haihais and Heiltsuk do not know how to marry, as they originate from a girl who "married" a dog. The Haisla have six clans, each named after an animal. Although the clans act as units in everyday matters, in most festivals (pot-latches and feasts) they are (except for the Eagle) linked with one or more of the other clans. Clan affiliations and rank are of the utmost importance—even more important than the biological family. As the clan occupies one village only, village grouping is of no importance. There is no trace of a formal moiety organization, except for a curious institution among the boys. A line through the centre of the village divides the boys into two groups, regardless of clan. Anyone crossing the line alone is liable to attack. On occasion they line up for sham battles. This rivalry is encouraged by the elders. Each clan has a number of crests, as, for example, in the Eagle clan—eagle, sea otter, ermine, owl, shag, a creature like an eagle with down-turned beak, hawk, halibut. This clan is sometimes termed Owl. The titles of nobility or rank are as carefully guarded and kept as the crests. They are variable in number for each clan, some belonging to men, others to women. Some of the higher chiefs have one or more "seconds" or helpers whose title may be rendered as "speaker". Though commoners and never chiefs, they are highly respected. Only the highest chiefs may have speakers, and they must be of the same clan. The office is inherited in the same way as other titles through the sister's son.

Early Growth of the Human Skull

IT is a matter of common observation that at birth the human head is still in a plastic condition—certain races take advantage of this to produce deformities—and that until it becomes finally fixed in the adult condition it undergoes unequal growth in different dimensions. These changes have been fully studied by means of a series of measurements, and the results analysed statistically by C. B. Davenport (*Proc. Amer. Phil. Soc.*, 83; 1940) on a full series of subjects. Apart from the detailed measurements which are given and illustrated by 170 growth-curves as examples, several general conclusions arrived at by the author are not without interest. First, due no doubt to the plasticity of the skull at birth, is the fact that environmental conditions play an important part in determining the final head shape. The changes in the proportions of the head are most marked in the first few weeks after birth due in part to the deformation caused by birth itself. Gravity has a flattening effect, which is noticeable as the child begins to sit up and to walk. Absolute cephalic measurements are less in the female than in the male in relation to her smaller size, and the mean cranial capacity is less in girls than in boys absolutely and in relation to stature and body modulus. The growth-curves of the heads of three pairs of monozygotic

twins show that, while in each pair they may lie close together or sometimes apart, they run in parallel courses. In similar curves of dizygotic twins no such correspondence is exhibited. Negroes have the greatest head-length and head-girth, while Nordic children have the largest post-auricular head segment and the largest height/length ratio.

A Study of Bird Migration

Too often in discussing bird migration use is made of general and somewhat nebulous observations which do not provide ground for arriving at satisfactory conclusions. James Ritchie (*Proc. Roy. Soc. Edinburgh*, 40; 1940) has furnished an example of the other method of approach by analysing, so far as possible, conditions associated with the appearance of an exceptionally large number of waxwings (*Bombicilla garrulus*) in Britain in November 1921 and checking this up with the corresponding records of the arrival of the same flights in Denmark. Accepting the not unreasonable assumption that the birds flew south at an average rate of twenty-five miles an hour and started in southern Scandinavia, as local records suggest, an explanation of their appearance in Britain can be given in terms of the direction and speed of the wind during the migration. This was generally one day later than the corresponding flights arrived in Denmark owing to the greater distance to be traversed. The author accepts the general proposition that the fundamental impulse to migration is associated with the reproductive cycle. He suggests that the birds tend to take off into the wind, so the direction of the wind may be a factor in determining the actual time of starting. In general, too, the migration took place in normal temperatures for the time of year following a sudden temporary drop and as a rule on cloudy or overcast days. It is suggested with regard to the latter conditions that they may enable the lung surface to keep moist without undue loss of the body water on a long-sustained flight.

Formation of Sand Cays

IN a paper on sand cays and their problems in the *Geographical Journal* of November, J. A. Steers traces the probable growth of these coral islets. The growth of the reef corals, the erosive action of waves in piling up blocks of coral rock, and the chance of seeds arriving and germinating are all familiar factors. He stresses, however, two other agencies in the growth of cays. Calcareous algae, especially *Halimeda*, help in the formation of sand which adds compactness and solidity to the loose formation and so prepares the ground for wind-carried seeds of higher plants. This action is explained at greater length in a companion paper by V. J. Chapman. The second process in stabilizing the cay, and one that Mr. Steers regards as of great importance, is the formation of beach-rock. In tropical waters a great deal of calcium carbonate is precipitated on or just beneath the surface of beaches and has the effect of cementing the sand into hard surfaces like paving stones. These slabs dip with the inclination of the beach. Their formation is limited to a small vertical range which is governed by tidal range and wave action. In Jamaica the range is three feet; in Australia it is four feet. It is generally formed in patches and seldom encloses a cay. Its formation seems to depend on many factors, and possibly the presence of vegetation may be a factor.

Once formed it protects the cay from wave action and encourages the growth of vegetation. But since it is rarely peripheral, wave action gets between and behind the slabs, and lines of beach rock may lie well away from the cays; some even lie at right angles to the shore of the cay.

Dipole Moments of Substituted Benzoic Acids

THE direction of the group moment associated with the carboxyl group has been considered by C. S. Brooks and M. E. Hobbs (*J. Amer. Chem. Soc.*, 62, 2851; 1940) in connexion with measurements on benzoic acid and some *para*- and *meta*-substituted halogen benzoic acids. Since the acids are normally associated even in dilute solutions in benzene, dioxane was used as the solvent. The mean direction of the carboxyl group moment was calculated as 74° with respect to the C-C line. No conclusion could be reached as to free rotation, as the values are compatible either with free rotation or with an equimolecular mixture of molecules in which the carboxyl group is fixed in the plane of the ring with the O-H in *cis*- and *trans*-positions, respectively, with respect to the *meta*-substituent in the benzene ring. A small discrepancy between the expected and observed values of the moments of *p*-chlorobenzoic acid and *p*-bromobenzoic acid is attributed to a resonance effect between the halogen and carboxyl groups in the benzene ring.

Monochromatic X-Rays

THE production of X-rays is always highly inefficient, since the greater part of the electrical energy put in is lost as heat. Even so, the product is still chromatic. When monochromatic radiation is needed, the inefficiency is still greater. R. Q. Gregg and N. S. Gingrich have reported (*Rev. Sci. Instruments*, October 1940) an interesting experimental comparison of the use of crystal-reflection and of filtration to get a monochromatic beam of molybdenum $K\alpha$ radiation ($\lambda = 0.708$ and 0.712 Å.). Although their special interest was in the X-ray diffraction patterns of liquids, the results are applicable to all work for which monochromatic X-rays are essential or desirable. In one set of experiments, using a General Electric Co. Mo-Target tube with an applied peak voltage of 37.0 kv., the diffraction patterns of liquid sodium were got after the original radiation had been reflected from calcite or from rock salt crystals, or after it had been filtered through various thicknesses of zirconium oxide with or without the addition of aluminium foil. The actual times of exposure used to blacken photographic film varied from 11 hours, when the direct beam from the X-ray tube was used, to 162 hours, when calcite reflection was used. When the times of exposure were reduced to times needed to produce an image density of 1, the differences were strikingly illustrated. Thus, the times were, for no filter, 8 hours; with rock salt reflection, 58 hours, and with calcite reflection, 356 hours. The general conclusions are that under these conditions calcite reflection is impracticable, that short exposure times can be obtained by using impure radiation, but that none of the reasonably satisfactory degrees of filtration is any more expedient than the use of rock salt reflection. The dangers of using partially filtered X-rays where a monochromatic beam is needed are well illustrated in graphs showing how an entirely spurious peak may appear on the intensity curve of the diffraction pattern.