

## RESEARCH ITEMS

## Ancient Indian Cultures

AN article by M. E. and D. H. Gordon (*J. Roy. Asiatic Soc. Bengal*, 6, No. 2; 1940) contains interesting information concerning their studies in the Indus valley. The prehistoric cultures exemplified by Harappa and Mohenjo-daro are not necessarily isolated from those of the early historic period, as certain objects have been found in mounds in Peshawar and other neighbouring districts which appear to carry on the ancient traditions. Moreover, painted pottery such as is found in these mounds is made in all the same localities to this day. This does not mean that there is no distinction between the present-day painted pots and those of the early historic periods; but there are certainly similarities, which, with the other evidence put forth, tends to show that there is no hiatus of 2,000 years in these Indian cultures. Ancient metal and stone workings in the eastern portion of Chota Nagpur have been excavated by E. F. O. Murray and described in "The Ancient Workers of Western Dhalbhum" (*ibid.*). The ethnology and geology of the district are dealt with briefly and a description given of the very interesting finds of pottery, beads and stone implements. The old mines are also described. The author concludes that they belong to an ancient culture of a higher level than that attained by the present inhabitants of the region.

## Nicotine Accumulation in Reciprocal Grafts of Tomato and Tobacco

THE distribution of nicotine between stock and scion in reciprocal grafts of tomato and tobacco was described by R. F. Dawson at the Autumn Meeting of the U.S. National Academy of Sciences held during October 13-15. When tobacco scions were grown upon tomato stocks no appreciable amounts of nicotine accumulated in the tobacco leaves or stems. In fact, the nicotine which was originally present in the scions remained in the lower leaves and stems, and the leaf and stem tissues which afterwards developed were nicotine free. When tomato scions were grown upon tobacco stocks nicotine was found in appreciable quantities in the tomato stems and fruits, and large quantities of the alkaloid accumulated in the leaves. Nicotine accumulation in the leaves of the tomato scions was sectoral when tobacco stems were decapitated and inserted into the tomato stems unilaterally. Nicotine was isolated from the xylem and the xylem exudate of the stems of intact tobacco plants. The evidence indicates that the presence of nicotine in tobacco leaves is due to (a) the synthesis of the alkaloid in the tobacco roots, (b) the translocation of the fully formed base (and not its precursor) to the leaves by way of the xylem, and (c) the continued accumulation of this nicotine in the leaves.

## Microscopic Structure of the Wool Fibre

A SERIES of twenty-seven microphotographs forms a special feature of a study of the fine details of structure of wool fibres by C. W. Hock, R. C. Ramsay and M. Harris (*J. Res. Nat. Bur. Standards*, Washington, D.C., 27, 181; 1941). Special attention was given to constituent scale and cortical cells. The individual cells were released by treating chemically modified wool with pepsin. The striated appearance of the cortical cells is due to the presence of many

fibrils which can be separated with microneedles. Between crossed nicols the fibrillar part of the cortical cells appears birefringent whereas the nucleus does not. The scales show little internal organization and appear non-birefringent between crossed nicols. A comparison of root and shaft of the fibre reveals many differences in reaction to microchemical colour tests as well as differences in cellular structure. The paper can be obtained also as Research Paper R.P. 1412 [10c] from the Superintendent of Documents, Washington, D.C.

## Heat of Sublimation of Carbon and Absorption Bands of Three Mesomeric Hydrocarbons

SPECTROSCOPIC analysis of the CO spectrum, together with thermochemical measurements on the burning of carbon in oxygen, lead to the conclusion that  $L$ , the heat of sublimation of carbon, is either 124 or 170 kcal./mol. G. J. Kynch and W. G. Penney (*Proc. Roy. Soc., A*, 179, 214; 1941) have made an estimate of  $L$  by calculating the energies of excited states of benzene, butadiene and hexatriene. Various values of  $L$  were assumed and the calculations were compared with experiment. Almost exact agreement was found for all three substances by assuming  $L = 170$ , and no agreement was found by assuming  $L = 124$ . The theory used is similar to that developed by Eyring for estimating activation energies. The equilibrium internuclear distances in the excited states are found, and the potential function controlling some of the vibrations about these positions is determined. The excited state of benzene has the regular hexagon configuration, with the carbon-carbon internuclear distance 1.45 Å., compared with 1.39 Å. in the ground state. The carbon-breathing frequency in the excited state is calculated to be 920  $\text{cm}^{-1}$ , compared with the experimental value 940  $\text{cm}^{-1}$ .

## Preparation of Deoxycholic Acid

THE preparation of deoxycholic acid from cholic acid was described by T. F. Gallagher and W. P. Long at the Autumn Meeting of the U.S. National Academy of Science held during October 13-15. When methyl cholate is oxidized at low temperatures with chromic oxide, the principal product is the methyl ester of 3-12-dihydroxy-7-keto-cholanic-acid, hitherto undescribed. A method for separation of this compound is given. Upon reduction by the method of Wolff-Kishner it is converted smoothly to deoxycholic acid in excellent yield.

## Structure of Soap Curd Fibres

SOME interesting photographs of the curd fibres of sodium laurate have been obtained by L. Marton, J. W. McBain and R. D. Vold (*J. Amer. Chem. Soc.*, 63, 1990; 1941) by means of the electron microscope with direct magnification up to 19,000 diameters. The results confirm previous conclusions based on less direct evidence. The curd is shown to consist of a mass of fibres which are thin ribbons with widths tending to be integral multiples of approximately twice the length of the sodium laurate molecules. In order that the carboxylate groups and methylene groups, respectively, may be adjacent to one another

in the manner found by X-rays for the monoclinic crystals, it would be expected that the fibres should be much wider than they are thick, and this agrees with the microscopic result. The fibres branch to form a felt, which accounts for the rigidity of the curd. The fibre junctions are also seen to give rise to many capillary spaces of variable diameter in which water can be retained, even at very low relative humidity. Some of the sodium laurate apparently is not a part of the fibrous structure but is present in granules 100–200 Å. in diameter irregularly spaced along the fibre. These were perhaps formed by rapid dehydration, during exposure of minute drops of solution, or may be related to aggregates pre-existing in the soap solution.

#### Effect of Ions on the Liquid Structure of Water

G. W. STEWART, in a paper read at the Autumn Meeting of the U.S. National Academy of Sciences held during October 13–15, discussed the effect of ions on the liquid structure of water. Water is unique in its liquid structure, and the influence of ions in solution on this structure becomes important experimental evidence. The results represent a considerable extension of an earlier report, and the conclusions therefrom are as follows: (1) With 41 strong electrolytes (so named in I.C. tables), out of a possible of approximately 200, the alteration in the X-ray diffraction pattern indicated that the ions caused an increase in the co-ordination bonds of the solvent water with a contraction in its volume. (2) With 37 of these, there was a rough but striking correlation between the rate of change of apparent molal ionic volume with concentration and the rate of change of the X-ray structure with concentration, the latter being determined in a somewhat arbitrary but consistent manner. The number of electrolytes was limited by the desirability of using only the lighter atoms. (3) With 3 of the strong electrolytes the rate of change of the apparent molal ionic volume occurred in the opposite direction although the change in water structure was similar to that with the others. The conclusion is that there are other factors in these special cases (the total number is only 6 in 200) which have the effect of decreasing the apparent molal ionic volume. Quantitatively, ionic temporary pairing might be such a factor. (4) There is a rough correspondence between the solubility of these electrolytes and their effect upon the structure of the water, the less the effect on the structure the greater being the solubility. (5) All these results are consistent with and seem to emphasize the tetrahedral structure of water changing with increasing temperature, this structure and these changes accounting for some of the unique characteristics of water.

#### New Compounds Fluorescent to X-Rays

New compounds fluorescent to X-rays consisting of pure isomorphous mixtures of the sulphates of barium and lead, have been discovered in the research laboratories of Ilford Limited by F. F. Renwick and H. S. Tasker, and form the subject matter of a recently issued British Patent No. 540,252. These materials, it is claimed, emit a strong violet and ultra-violet fluorescence, without afterglow when excited by X-rays, but show no fluorescence under ultra-violet light illumination. Being insoluble and inert towards photographic emulsions, they are likely to prove valuable, not only for the manufacture of X-ray intensifying screens, but also in composite units

embodying both screen and emulsion on a single support. They appear, moreover, to be unique in that they can be prepared by double decomposition in an active micro-crystalline form by the simple interaction of a solution containing salts of barium and lead with a solution of a sulphate, without the necessity for a subsequent firing treatment, as is essential in the preparation of all the well-known fluorescent salts, such as calcium and other tungstates, zinc sulphide and zinc silicate. When a firing operation is also employed, their fluorescence is stated to be considerably enhanced, and products rivalling the most highly fluorescent calcium tungstates are said to be obtainable. This addition to the list of useful fluorescent compounds will doubtless interest not only radiologists but also those research workers who make a special study of fluorescence phenomena.

#### Bombardment Experiments with Protons on Boron

WHEN boron is bombarded with protons, two groups of  $\alpha$ -particles are found, one a group with continuous distribution in range and maximum range of 3.7 cm., the other a group with homogeneous range of 4.4 cm., according to A. Ellet and J. Jacobs in a paper read at the Autumn Meeting of the U.S. National Academy of Sciences held during October 13–15. The excitation function of each group was studied in the range 100–200 keV., and in each case showed a resonance at  $158 \pm 3$  keV. The resonance for the continuous group had not been previously found. The distribution in angle of each group at resonance and of the continuous group just above resonance (175 keV.) was measured. Both groups showed asymmetry at resonance (in agreement with previous reports); but the continuous group was observed to possess spherical symmetry above resonance (in contradiction to previous reports). The resonance yields of the  $\alpha$ -particles of each group are presumed to have a common origin, a *p*- or *d*-proton capture. The non-resonance yield of the continuous group is presumed to arise from an *s*-type capture. The results are in agreement with certain theoretical considerations.

#### Maxima of Absorption Lines in Stellar Spectra

THE maxima of absorption lines in stellar spectra were described by P. C. Keenan at the Autumn Meeting of the U.S. National Academy of Sciences held during October 13–15. The accurate spectral types recently determined at the Yerkes Observatory for a large number of stars provided the basis for improved estimates of the spectral types (and corresponding effective temperatures) at which the stronger atomic lines and molecular bands reach their maximum intensity. In giant stars the neutral iron lines of *e.p.* 1.5v. show a maximum at type *K5* ( $T_e = 3600^\circ \pm$ ) while those with *e.p.* 2.4v. are strongest near *K3* ( $T_e = 3850^\circ \pm$ ). In dwarfs the behaviour of these lines is similar but less clearly differentiated. Among the lines of ionized elements which persist to low temperatures, the *K*-line of  $\text{Ca}^+$  shows no marked falling off in strength through the coolest observable giants (type *M5* with  $T_e < 3000^\circ$ ), but has a maximum for the dwarf stars near *K5*. Bands of CN are strongest at *K1* in giants and at *G7* in supergiants, while remaining weak in dwarfs at all temperatures. The  $\lambda 4300$  band of the CH molecule behaves similarly, but has maxima about five spectral subdivisions earlier than those of CN.