

J. Chem. Soc., 429 (1935); Lehmann and Paasche, *Ber.*, **68**, 1147 (1935)], we wish to reserve for full description and further study the methods and compound types indicated above.

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NEW MEASUREMENTS OF PREVIOUSLY UNKNOWN LARGE INTERPLANAR SPACINGS IN NATURAL MATERIALS

Sir:

There is at present intense interest and importance in the discovery and measurement of very large interplanar spacings (for example, greater than 40 Å.) in natural materials such as proteins, rubber, cellulose, etc. By ordinary x-ray diffraction technique interferences corresponding to such spacings are not resolved from the blackening of the photographic film due to the undeflected primary x-ray beam. Recourse must be taken, therefore, to the following procedures: (1) with a given primary x-ray wave length, usually the $K\alpha$ of copper, decrease pinhole sizes to 0.005 inch, increase specimen to film distances from 5 cm. usually employed to 20–30 cm., and center very small lead beads with extraordinary care over the point of impingence on the film of the unabsorbed primary beam; (2) increase the x-ray wave length λ by the use of magnesium or aluminum targets, since $\sin \theta$ ($2\theta =$ diffraction angle) increases with the value of λ for a given spacing. We have succeeded in improving the technique of both methods (for the latter by placing the vacuum camera in a magnetic field to deflect scattered electrons which fog diffraction films) to such an extent that definite and reproducible results on unsuspected large spacings have been obtained for a variety of materials:

(1) Living nerve: various orders of a spacing of 171 Å. in fresh medullated nerve, due probably to oriented fluid crystals of the myelin sheath. This c spacing lies radial and perpendicular to the long direction of the axon [for extended accounts see *Science*, **80**, 567 (1934); **82**, 44 (1935); *Radiology*, in press.]

(2) Collagen and gelatin: in collagen (catgut) beautifully resolved meridional interferences (along fiber axis) in 4 orders of a spacing of 220 or 440 Å. (204 or 408 for chromicized catgut), and an equatorial or lateral spacing of 48 Å.

which is exceptionally sensitive to any treatment, even sterilization. These large spacings are *completely absent* in gelatin, whereas the outer ordinary patterns for collagen and stretched gelatin are identical.

(3) Keratin: a lateral or equatorial spacing of 81 Å., verifying a prediction by Astbury that a lateral spacing of approximately 90 Å. should exist.

(4) Gel rubber: for the fraction of rubber insoluble in ether a well defined ring for 58 Å. in unstretched rubber, which segments into equatorial sickles on stretching. Sol rubber gives *no* such large spacing interferences.

(5) Cellulose: for cellulose there is definite but somewhat diffuse scattering at very small angles. Equatorial maxima like small arrow heads, but thus far unresolved into a series of individual spots, run out from this halo.

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4'-HYDROXY-1,2-BENZOPYRENE

Sir:

In view of the statement of Winterstein, Vetter and Schön [*Ber.*, **68**, 1079 (1935)] that they are attempting to prepare the hitherto unknown 4'-hydroxyl derivative of 1,2-benzopyrene [numbering system of Cook and Hewett, *J. Chem. Soc.*, 398 (1933)] by the dehydrogenation of 4'-hydroxy-1',2',3',4' - tetrahydro - 1,2 - benzopyrene, we may report the preparation of the compound in question by another method. In previous studies of the action of selenium on 4'-keto-1',2',3',4' - tetrahydro - 1,2 - benzopyrene [Cook and Hewett, *loc. cit.*; Winterstein and Vetter, *Z. physiol. Chem.*, **230**, 169 (1934)] the only pure product isolated was 1,2-benzopyrene. Using the amount of selenium required for the removal of two hydrogen atoms and heating for two hours at 310–320°, we have isolated 4'-hydroxy-1,2-benzopyrene in small amounts. Using sulfur in place of selenium (seventy-five minutes at 220–230°) we obtained the completely pure hydroxy compound in 19% yield from the crude ketone.

4'-Hydroxy-1,2-benzopyrene forms yellow elongated plates, m. p. 218–219°, corr., from benzene-ligroin (calcd.: C, 89.52; H, 4.51. Found: C, 89.59; H, 4.76). The corrected melting points