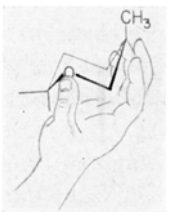
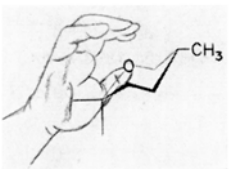
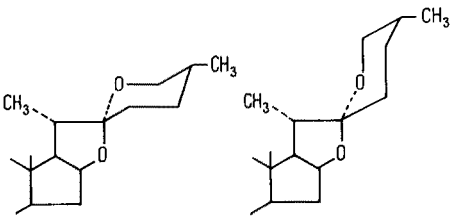
By this method the handling of the methyl group at carbon 25 becomes simple and informative. The use of 25*D* and 25*L* expresses absolute configuration at carbon 25 in the open or closed ring, it fosters straight-forward nomenclature, and it lends itself to the useful right- and left-hand mnemonic. The latter is illustrated[4] below for a 25*D* carbon atom, using the right hand in each case, to




show operation of the method in dealing with both possible configurations at carbon 22. It requires imaginary




orientation of the right hand so the wrist is correspondent with carbon 22 and the thumb with the ring-F oxygen atom. The methyl then lies in the direction indicated by the natural curve of the fingers. The left hand is used similarly for 25*L* sapogenins. Conformational changes incurred through conversion from one chair form to another, as illustrated, or even to a boat form, do not alter configuration at carbon 25 and the method remains valid.

By remembering that the isosapogenins belong to the 25*D* family and the normal or neosapogenins to the 25*L* family, one is able handily to categorize any written stereochemical formula. Conversely, this mnemonic offers a quick, convenient device to assist in writing, verification, discussion, and naming of spirostan formulas.

*Zusammenfassung.* Die Beweggründe für den Gebrauch der *D*- und *L*-Konvention in der Nomenklatur der Steroid-Sapogenine sowie ihre Anwendung auf die Konfigurationsanalyse und Formelaufstellung werden diskutiert.

G. P. MUELLER

*G. D. Searle and Co., Skokie (Illinois, U.S.A.), March 12, 1962.*

[4] Thanks are due Dr. L.J.CHINN for his preparation of the sketches.

## The Hydroxyskatoles

Substances which are considered to be sulphatoxyskatoles or their degradation products appear to be excreted in the urine in certain pathological conditions (for references see SPRINCE[1] and RODNIGHT[2]). However, until recently, none of the corresponding hydroxy compounds had been described in the literature.

In 1956 TEUBER and STAIGER obtained a substance which they described as 5-hydroxyskatole by the action of potassium nitrosodisulphonate on 2,3-dihydroskatole but neither any proof of structure nor analytical data were given[3]. Three years later HORNING et al. reported the preparation of 6-hydroxyskatole by the hydrogenation of 6-benzyloxyskatole (obtained by an application of the Fischer Indole synthesis). However, no experimental details were given[4]. In 1961 ACHESON and HANDS obtained 5-hydroxyskatole by the hydrogenation of 5-benzyloxygramine in the presence of Adams Platinum catalyst[5]. These authors later reported that the hydrogenation of 6-benzyloxygramine in the presence of the same catalyst gave what appears to have been a mixture of 6-hydroxyskatole and 6-benzyloxyskatole along with unchanged starting material[6].

[1] H. SPRINCE, Clin. Chem. *7*, 203 (1961).
[2] R. RODNIGHT, in International Reviews of Neurobiology (ed. by C. C. PFEIFFER and J. R. SMYTHIES, Academic Press, New York 1961), vol. 3, p. 251.
[3] H. J. TEUBER and G. STAIGER, Chem. Ber. *89*, 489 (1956).
[4] E. C. HORNING, C. C. SWEELEY, C. E. DALGLIESH, and W. KELLY, Biochim. biophys. Acta *32*, 566 (1959).
[5] R. M. ACHESON and A. R. HANDS, J. chem. Soc. *1961*, 746.
[6] R. M. ACHESON and A. R. HANDS, Biochim. biophys. Acta *51*, 579 (1961).

The hydroxyskatoles

| Hydroxyskatole position of OH group | M. p. (°C) | M. p. reported in literature | Crystalline form | Analysis found C | H | N | calculated C | H | N |
|---|---|---|---|---|---|---|---|---|---|
| 4–[a] | 123 | — | Colourless small prisms from benzene/light petroleum[b] | 74.00 | 6.07 | 9.34 | 73.45 | 6.16 | 9.52 |
| 5– | 114 | 108–109[3], 116[5] | Colourless prisms from benzene light petroleum[b] or chloroform/carbon tetrachloride | 73.72 | 6.22 | 9.52 | 73.45 | 6.16 | 9.52 |
| 6–[a,c] | 162 | 149–151[4] | Colourless fine plates from benzene/light petroleum[b] | 73.22 | 6.24 | 9.63 | 73.45 | 6.16 | 9.52 |
| 7–[a] | 82.5 | — | Colourless fine needles from light petroleum[b] | 73.75 | 6.43 | 9.27 | 73.45 | 6.16 | 9.52 |

[a] Analytical samples were purified on a silica-gel column with adsorption from benzene and elution with 2% ethyl acetate in benzene.
[b] B.D.H. AnalaR grade (B.p. 80–100°).
[c] The methyl ether was prepared by the action of dimethyl sulphate in boiling benzene on the anhydrous sodium derivative of 6-hydroxyskatole, and purified by sublimation *in vacuo* and recrystallisation from light petroleum.

We have now prepared crystalline samples of the 4-, 5-, 6-, and 7-hydroxyskatoles by the hydrogenation of the corresponding benzyloxygramines in the presence of a 10% palladium on charcoal catalyst. The melting point for the 6-hydroxyskatole obtained by this method was 11–13° higher than that reported by HORNING et al.[4]. However, the O-methyl ether has been prepared and has the same melting point (125°) as that previously reported by BLAIKIE and PERKIN for 6-methoxyskatole[7].

The following experimental procedure was employed in all cases: A solution of the benzyloxygramine[8] (200 mg) in methanol (100 ml) was shaken overnight with hydrogen (60 lb./sq.inch) at room temperature in the presence of a 10% palladium on charcoal catalyst (ca. 70 mg)[10]. The reaction mixture was filtered; after removal of the solvent, the resulting crude hydroxyskatole was purified by recrystallisation from a suitable solvent or chromatographically on a silica-gel[11] column. All operations were carried out in an inert atmosphere. The properties of the compounds prepared and the method of purification are given in the Table[12].

*Zusammenfassung.* Synthesen und Eigenschaften von 4-, 5-, 6- und 7-Hydroxyskatol werden beschrieben.

R. A. HEACOCK and O. HUTZINGER

*Psychiatric Research Unit, University Hospital, Saskatoon (Saskatchewan, Canada), March 2, 1962.*

[7] K. G. BLAIKIE and W. H. PERKIN, J. chem. Soc. *1924*, 296.

[8] With the exception of the 4-benzyloxy compound all the benzyloxygramines were available commercially (Regis Chemical Co.); the 4-benzyloxygramine was prepared from 4-benzyloxyindole by the method of STOLL et al.[9].

[9] A. STOLL, F. TROXLER, J. PEYER, and A. HOFMANN, Helv. chim. Acta *38*, 1452 (1955).

[10] The catalyst was moistened with water to reduce the danger of spontaneous ignition on contact with the methanol.

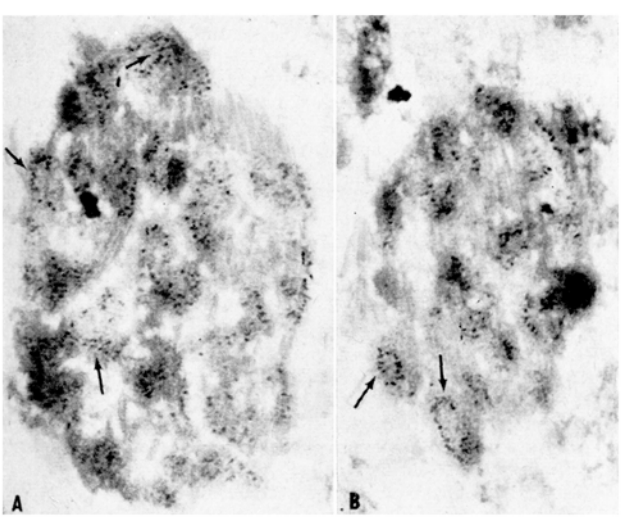
[11] Obtained from L. Light & Co.

[12] This investigation was supported by grants from the Department of National Health and Welfare (Ottawa) and the Government of Saskatchewan (Department of Public Health).

## Electron Dense Inclusions in the Nucleoli of the Myxomycete *Physarum polycephalum*[1]

Electron dense inclusion have been observed in the nucleoli of a variety of organisms either as a component of the 'nucleolonemata'[2–5] or without an apparent relation to these[6]. Some observers describe them as granular particulates[2–4,6], others as coiled threads[5]. Electron dense structures also occur in the nucleoli of the myxomycete *Physarum polycephalum*. In this coenocytic organism the nuclei divide in synchrony and the nuclear membrane persists throughout the mitosis[7].

Nucleoli from any stage of the mitotic cycle contain filamentous structures ('nucleolonemata'[8]), which are visible under phase-contrast in ethanol-fixed smear preparations. At the high resolution of the electron microscope (fixation with osmic acid), these filaments appear to be composed of material of high electron density embedded in a less dense ground substance (Figure). Superficially, the dense material appears as vaguely outline 'granules'. However, the frequently linear arrangement and shape of these 'granules' (see arrows) suggests that they actually represent pieces of coiled threads which are sectioned at various angles to, and at various distances from their axis. After the disintegration of the nucleoli during prophase, the electron dense inclusions are found as comparatively large (100–800 Å) granules surrounding the spindle and the chromosomes. At telophase, they reappear along the chromosomes. A study is under way to determine the relation between the chromosomes on the one hand and the electron dense material and the surrounding ground substance on the other.




Nucleoli of *Physarum polycephalum*, osmium-fixed material, magnification ×28000. Arrows pointing at structures suggestive of coiled threads embedded in a ground substance of lower electron density.

*Zusammenfassung.* Der Nucleolus des Schleimpilzes *Physarum polycephalum* enthält Strukturen, die vermutlich dem Nucleolonema (ESTABLE und SOTELO[8]) homolog sind. In diese eingebettet finden sich Elemente, die sich elektronenmikroskopisch, nach Osmiumfixierung, mit starkem Kontrast abheben und anscheinend fadenförmig sind.

E. GUTTES and R. A. ELLIS

*Department of Biology, Brown University, Providence (Rhode Island, USA), March 12, 1962.*

[1] This investigation was supported by USPHS Grant No. RG-8495.

[2] W. BERNHARD, A. BAUER, A. GROPP, F. HAGUENAU, and CH. OBERLING, Exp. Cell Res. *9*, 88 (1955).

[3] E. HORSTMANN and A. KNOOP, Z. Zellforschg. *46*, 100 (1957).

[4] K. KUROSUMI, T. KITAMURA, and T. IIJIMA, Arch. histol. jap. (Okayama) *16*, 523 (1959).

[5] G. YASUZUMI, T. SAWADA, R. SUGIHARA, M. KIRIYAMA, and M. SUGIOKA, Z. Zellforschg. *48*, 10 (1958).

[6] J. G. LAFONTAINE, J. biophys. biochem. Cytol. *4*, 777 (1958).

[7] E. GUTTES, S. GUTTES, and H. P. RUSCH, Develop. Biol. *3*, 588 (1961).

[8] C. ESTABLE and J. R. SOTELO, Instituto de Investigaciones de Ciencias Biologicas Publicaciones *1*, 47 (1951).