

THE AUTOXIDATIVE RING CONTRACTION OF BLOCKED TETRAHYDROPTERIDINES:

ORIGIN OF INTRODUCED OXYGEN FUNCTION.

J.A. Blair and A.J. Pearson

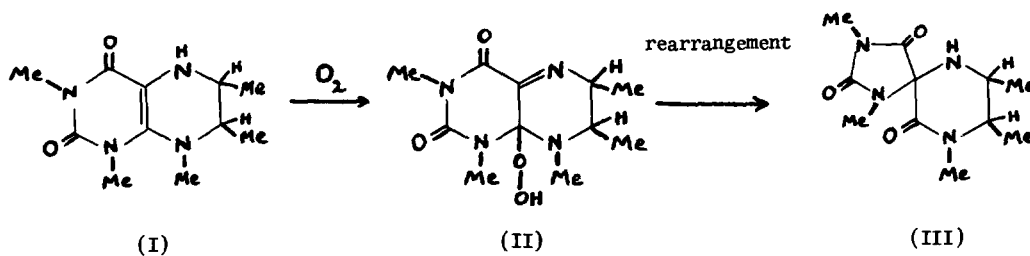
Department of Chemistry, University of Aston in Birmingham,
Gosta Green, Birmingham B4 7ET.

(Received in UK 15 March 1973; accepted for publication 28 March 1973)

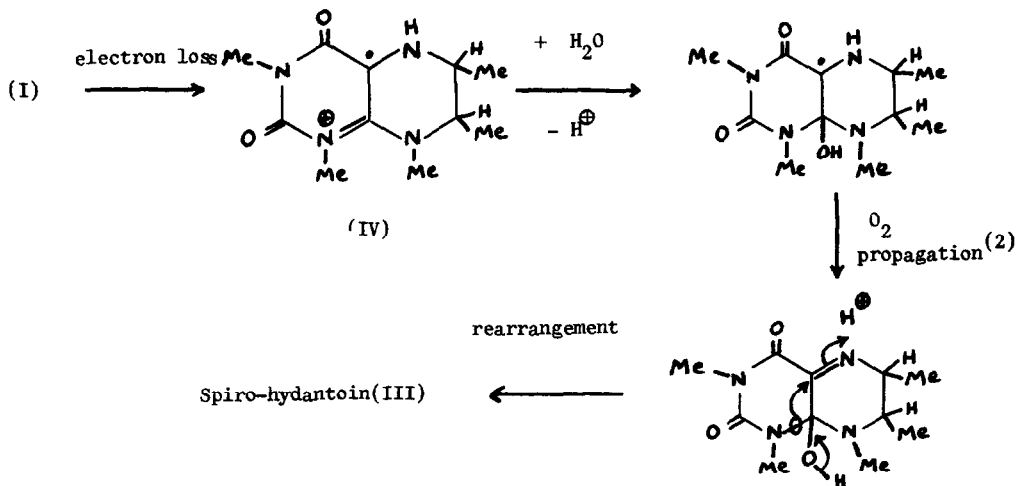
It has been established⁽¹⁾ that 1,3,6,7,8 - pentamethyl - 5,6,7,8 - tetrahydropteri - 2,4 - dione (I) undergoes a contraction of the pyrimidine ring, when autoxidised in water, to give 4,1',3' - trimethyl - 3 - oxopiperazine - 2 - spiro - 5' - hydantoin (III). This has been presented⁽¹⁾ as evidence for the intermediacy of transient 8a - hydroperoxides(II) in the autoxidation (scheme 1), a postulate which is not in agreement with kinetic data which we have reported⁽²⁾.

We have now shown conclusively that the new oxygen function introduced during the reaction is derived from the water used as solvent. The blocked pteridine (10 mg.) was dissolved in pyridine/water (10:1, 2 cm³) and shaken under oxygen for two days, and the solvent was then removed under vacuum. The mass spectrum of the product corresponded to a mixture of spiro - hydantoin⁽¹⁾ (M⁺, m/e = 254) and starting material (M⁺, m/e = 238). The experiment was repeated using oxygen - 18 enriched water (43.46% enrichment), when the resulting mass spectrum showed that no isotopic exchange between the starting material amide groups and water had occurred (M⁺ at m/e = 238 obtained, but no peaks at m/e 240 or 242). However, the spiro - hydantoin spectrum showed the incorporation of ¹⁸O (M : M + 2 ratio 1.6; theoretical ratio, from water = 1.53). Treatment of the labelled product with H₂¹⁶O did not lead to loss of label (shown by persistence of M + 2 at m/e = 256). This demonstrates that the label is introduced by addition of water and not through exchange and this is not consistent with the mechanism proposed by Mager and Berends⁽¹⁾. It is probable that the addition occurs at the radical - cation stage (IV) and not at the quinonoid stage, since no 7,8 - dihydropteridine is observed in the products⁽¹⁾, as would be expected from rearrangement of the quinonoid form (see, for example, reference 2). A reasonable mechanism is presented in scheme 2, not requiring the formation of 8a - hydroperoxides, and in which molecular oxygen is reduced to hydrogen peroxide.

Scheme 1 (Mager & Berends⁽¹⁾):-



Scheme 2:-



Acknowledgements

Thanks are due to Prof. H.I.X. Mager for a generous gift of the blocked pteridine (I), and to Mr. M. Horton for mass spectra.

References.

- (1) H.I.X. Mager and W. Berends, *Rec. Trav. Chim.* 91, 1137, (1972)
- (2) J.A. Blair and A.J. Pearson, *Tetrahedron Lett.*, No. 3, 203, (1973).