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BICYCLO[3.3.1]NONANES AS SYNTHETIC INTERMEDIATES VI.[1] AN OXAADAMANTANOL INTERMEDIATE WHICH FUNCTIONS IN THE HIGHLY CHEMOSELECTIVE RING-ENLARGEMENT OF BICYCLO[3.3.1]NONANE-3,7-DIONE BY DIAZOMETHANE

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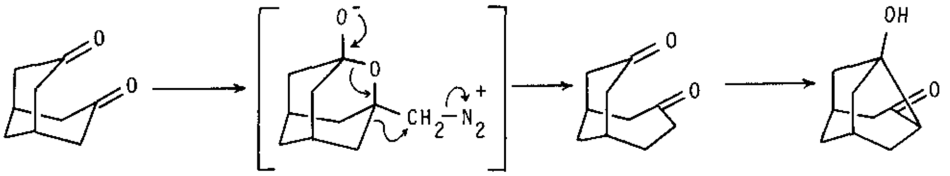
Abstract ——The chemoselective synthesis of bicyclo[4.3.1]-decane-3,8-dione (**3**) and 8-hydroxytricyclo[4.3.1.$0^{3,8}$]decan-4-one (**4**) from bicyclo[3.3.1]nonane-3,7-dione (**1**) is described. Formation of an oxaadamantanol intermediate was shown to conduct the reaction and to realize its high chemoselectivity, because the monoketone bicyclo[3.3.1]nonan-3-one (**5**) failed to react with diazomethane.

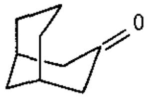
There have been reported two modes of transannular cyclization of the 3,7-difunctionalized bicyclo[3.3.1]nonane system, one forming the noradamantane skeleton as demonstrated, for example, in the photolysis[2] of bicyclo[3.3.1]nonane-3,7-dione (**1**)[3] or 7-methylenebicyclo[3.3.1]nonan-3-one (**2**)[3] or in the Wolff-Kishner reduction[4] of **2**, and the other forming the oxaadamantane skeleton as in the reaction of **1** with Grignard reagent[5] or some other nucleophiles.[6] The ionic reactions usually favor the latter mode. In a previous paper,[7] we postulated an elusive oxaadamantanol intermediate in the Baeyer-Villiger oxidation of **1**. Present paper describes the second example of such a transient intermediate, which functions in the highly chemoselective ring-enlargement of **1** into bicyclo[4.3.1]-decane-3,8-dione (**3**).

The reaction of diazomethane with alicyclic ketones in the absence of Lewis acid catalysis generally results in formation of some epoxides and higher homologues of the ketones.[8] Application of this reaction to bicyclic ketones such as bicyclo[3.3.1]nonane-2,6-dione[9] and bicyclo[3.3.1]nonan-2-one[10] has also been reported to give complex isomeric products. However, the reaction of **1** was



1 3 4

found to proceed chemoselectively to give 3, which was gradually transformed into a ketol (4) via the intramolecular aldol reaction on standing at room temperature. The ring-expansion reaction of 1 was carried out in wet methanol by the controlled addition of the ethereal solution of diazomethane followed by removal of the solvent under reduced pressure and below room temperature. Only one product (3) [IR(KBr): 1700cm^{-1}(C=O); PMR($CDCl_3$): δ 1.70-3.00(ring protons, unresolved); MS(m/e): 166(M^+, 40%) with satisfactory combustion data] was obtained in quantitative yield. No appreciable amount of epoxides and higher homologues were detected on examination of the IR and PMR spectra and GLC analysis[11] of the crude product. The failure in formation of side products in the present system can be rationalized in terms of specific acceleration of the single homologation by through-space interaction between the C-3 and C-7 carbonyls. Meanwhile, the monoketone (5)[3d] was found unreactive to diazomethane owing probably to the backside steric hindrance due to the endo C-7 hydrogen as in the case of the Baeyer-Villiger reaction.[7]



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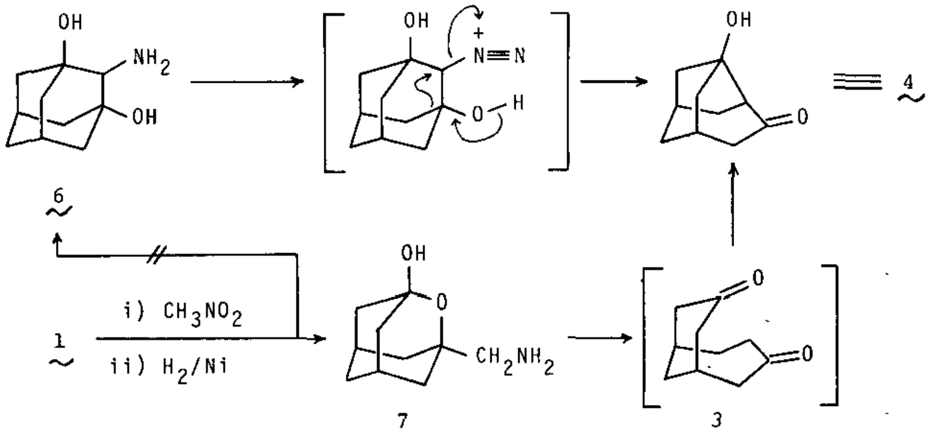
McKervey et al.[12] had reported a synthesis of the protoadamantanone (4) from



6 ≡ 4 1 7 3

2-aminoadamantane-1,3-diol (6) by diazotization. As the starting material was corrected as an oxaadamantanol (7),[13] the reaction would follow the same process as shown above, because the diketone (3) was found to cyclize readily not only thermally but by acid or base catalysis into 4 quantitatively. The transformation 7 ⟶ [3][14] ⟶ 4 eventually demonstrates that the oxaadamantanol intermediate in the present system is actually the case.

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14. Concomitant formation of a small amount of 3 and its facile thermal conversion into 4 were described, but without any comments on the mechanism for the former: see ref. 12.

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