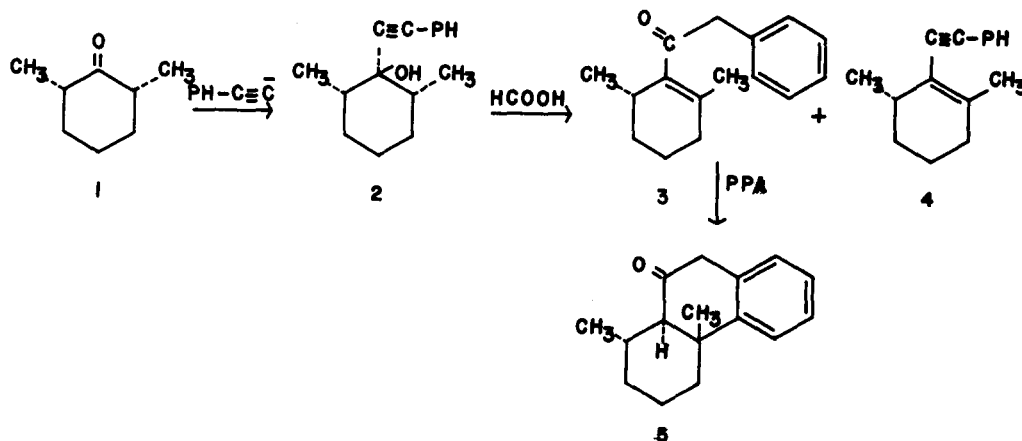


A NOVEL METHOD OF ANNELETION  
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In our studies toward the total synthesis of deca-nor triterpenoids<sup>1,2</sup> we were required to develop a method of annelation which allows the incorporation of an angular methyl group and a ketone group at position 11 in quassin<sup>3</sup>. The potentiality of general application of this reaction prompts us to communicate our results at the present time as applied to 2,6-dimethyl-cyclohexanone (1). The following sequence provides a 50% overall yield in three steps.



The Nef reaction of (1) with sodium phenyl acetylide in liquid ammonia led to the acetylene alcohol (2) in a quantitative yield. Oil; mass spec (70 ev)  $m/e$   $M^+$  228; ir ( $CCl_4$ )  $cm^{-1}$  3400, 2950; nmr ( $CCl_4$ )  $\tau$ : 8.85 (d, 6 methyl protons) 8.60 (m, 8, cyclohexane protons), 2.80 (m, 5, aromatic protons);  $uv_{max}$  (95% EtOH)  $m\mu$ , ( $\epsilon$ ) 252 (17,100) 242 (20,200), 208 (19,460).

The Rupe rearrangement of (2) using boiling formic acid led to a 60% yield of unsaturated ketone (3). Oil; mass spec. (70 eV) m/e (rel. intensity) no parent peak, 137 (60), 109 (100), 91 (50);  $uv_{\max}$  (95% EtOH)  $\mu$ , ( $\xi$ ) 244 (3800), 211 (8044); ir ( $CCl_4$ )  $cm^{-1}$  1680 (O=C=C), 1600; nmr ( $CCl_4$ )  $\tau$  : 9.18 (d, 3, J=8Hz,  $\underline{CH_3}$  - CH), 8.40 (s, 3,  $CH_3$ -C=C), 6.40 (s, 2, O=C- $\underline{CH_2}$ - $C_6H_5$ ), 2.83 (s, 5, aromatic protons). The byproduct of the formic acid treatment might have been the acetylenic hydrocarbon (4) which however could not be characterized due to polymerization.

The unsaturated ketone (3) was cyclized by heating its polyphosphoric acid solution at 120° for ten minutes. After the usual work-up a crystalline saturated ketone (5) was isolated in 80% yield. Mp. 64-65°; mass spec (70 eV) m/e (rel. intensity)  $M^+$  228 (70), 213 (82), 195 (100);  $uv_{\max}$  (95% EtOH)  $\mu$ , ( $\xi$ ) 282 (1384), 209 (9300); ir ( $CCl_4$ )  $cm^{-1}$  1710 (sat.C=O); nmr ( $CCl_4$ )  $\tau$  : 9.20 (d, 3, J = 7Hz,  $\underline{CH_3}$ -CH), 8.93 (s, 3, angular  $CH_3$ ) 6.50 (s, 2, O=C- $\underline{CH_2}$ ) 2.80 (m, 5, aromatic protons).

The A-B ring junction in ketone (5) is assigned to be trans since an attempt to isomerize it with hydrochloric acid in methanol resulted in the recovery of the starting material. The angular methyl group is therefore regarded to be in the axial position. Such a stereochemical outcome, however could be anticipated by assuming a nearly coplanar transition state for the cyclization. The scope of the method is currently being investigated with methoxy substituted phenyl acetylenes and other ketones of synthetic interest.

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