Tetrahedron Letters, Vol. 33, No. 47, pp. 7253-7254, 1992
Printed in Great Britain

0040-4039/92 $5.00 + .00
Pergamon Press Ltd

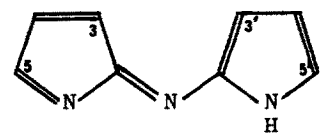
A Convenient Synthesis of Azapyrromethines+

Clive W. Bird* and Lu Jiang

Department of Chemistry, King's College,
The Strand, London WC2R 2LS, U.K.

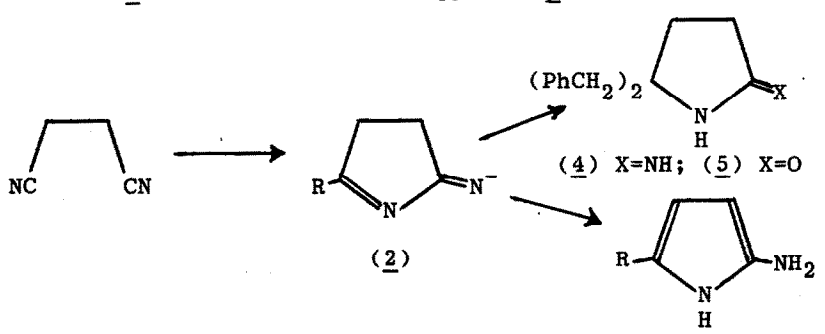
Abstract: *5,5'-Diarylazapyrromethines are conveniently prepared by the reaction of aryl Grignard reagents with succinonitrile.*

Azapyrromethines (1) are of interest both as dyes and as potential components of organic semiconductors. The 3,3',5,5'-tetraaryl derivatives have been obtained either by direct reaction of δ-nitrobutyrophenones, $O_2NCH_2CHArCH_2COAr$, with ammonium formate or formamide or by the condensation of a 2,4-diarylpyrrole with its 5-nitroso derivative[1]. The scope of the latter route is limited by the apparent preference of pyrroles to undergo nitrosation at the β-position. 5,5'-Diarylpyrromethines have been produced by the reaction of β-aroylpropionitriles with hydroxylamine salts[2]. We now wish to report a quick and convenient route to azapyrromethines which has emerged from a projected synthesis of 2-aminopyrroles.



(1)

As indicated in Scheme I our proposed synthesis entailed the addition of a carbanion to succinonitrile accompanied by intramolecular cyclisation to give the putative intermediate (2). Subsequent prototropic rearrangements were then expected to result in the conversion of (2) to the aromatic 2-aminopyrrole (3). Initial experiments with



SCHEME I

both benzyllithium and benzylmagnesium chloride resulted solely in the isolation of the pyrroline (4), which could be hydrolysed with aqueous sodium hydroxide to the pyrrolidone (5). The structure of these compounds followed from their analytical and

+Dedicated to Professor C.W. Rees on the occasion of his 65th birthday.

spectroscopic properties[3]. Clearly addition of a second mole of reagent to (2) occurs more rapidly than the desired tautomerisation to (3). An analogous product to (4) has been obtained from benzylmagnesium chloride and glutaronitrile[4].

Utilisation of an aryl Grignard reagent would be expected to yield a less reactive intermediate corresponding to (2) thereby slowing down the rate of further addition and thus enhancing the possibility of tautomerisation. In practice[5] the reaction of phenylmagnesium bromide with succinonitrile provided a basic product which rapidly decomposed on attempted isolation either as the free base or as an N-acyl derivative. However, on standing with access to air aqueous acidic solutions of this base deposit the hydrochloride of 5,5'-diphenylazapyrromethine in the form of a blue black solid, which yields a deep blue solution in ethanol with λ_{max} 595 nm., ε = 18,000 characteristic of such systems. It has been noted previously[1] that 2-amino-3,5-diphenylpyrrole readily forms the corresponding azapyrromethine in acidic media and we assume that our product has a similar genesis from the anticipated 2-amino-5-phenylpyrrole although the mechanistically more attractive dimerisation of the intermediate (2) cannot be excluded.

Analogous azapyrromethines have been obtained from the reaction of p-tolyl-, p-anisyl-, and 2-thienylmagnesium bromides with succinonitrile. Although the yields of azapyrromethines obtained by this method are as yet fairly modest, *ca.*10%, the process provides a rapid one step access to a range of derivatives of this little known system from readily available precursors.

REFERENCES

1. Rogers, M.A.T., *J. Chem. Soc.*, 1943, 590.
2. Knott, E.B., *J. Chem. Soc.*, 1947, 1196.
3. (4),HCl mp. 95°C, ^{1}H nmr(DMSO-d^{6}) δ 1.72(t, 2H,J=8.0Hz),1.95(t, 2H,J=8.0Hz),2.90 (d, 2H,J=13.6Hz),3.04(d, 2H,J=13.6Hz),7.2-7.4(m,10H),8.73(NH),8.81(NH),10.37(NH); ^{13}C nmr δ 27.30(CH_2),29.50(CH_2),44.73(CH_2),69.57(qC),126.78(CH),128.24(CH),130.62 (CH),136.12(qC),169.49(C=N).
   (5) mp. 143°C, ^{1}H nmr($CDCl_3$) δ 1.63(dd, 2H,J=7.8 & 8.5Hz),2.02(dd, 2H,J=7.8 & 8.5 Hz),2.81(d, 2H,J=13.6Hz),2.91(d, 2H,J=13.6Hz),6.63(s,NH),7.15-7.35(m,10H); ^{13}C nmr δ 27.24(CH_2),30.10(CH_2),46.23(CH_2),62.00(qC),126.34(CH),127.96(CH),130.72(CH), 137.06(qC),175.85(C=O).
4. Bruylants, P., and Dewael, A., *Bull. sci. acad. roy. Belg.[5]*,1926, 12, 464 (*Chem. Abstr.*, 1927, 21, 1108).
5. A solution of succinonitrile (10g,0.125mole) in benzene (100 ml) was added to an ethereal solution of phenylmagnesium bromide prepared from bromobenzene (20g,0.125 mole) and magnesium (3.2g,0.133mole) in ether (300 ml).The reaction mixture was refluxed for 2 hours and then poured into a saturated aqueous ammonium chloride solution. The tar which separated at the ether/aqueous interface was separated and extracted with 2M hydrochloric acid. The initially colourless solution rapidly darkened and slowly deposited the azapyrromethine hydrochloride. The rate of deposition could be accelerated by bubbling air through the extract. The product could be purified by chromatography in ethanol/chloroform over silica gel.

(Received in UK 2 September 1992)