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POLYCYCLIC ARENE IMINES

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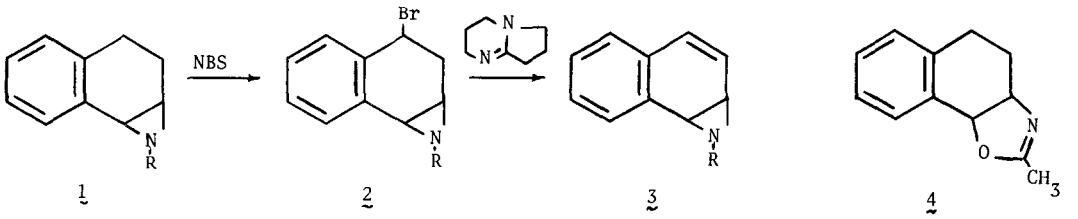
Polycyclic arene oxides have been the focus of considerable research in recent years owing to their theoretical and biological relevance [1] Of similar interest,[2] but yet unreported, are polycyclic arene mono-imines Recent findings by Bicker and Fischer[3] imply that some of the title compounds may play a similar part in chemical carcinogenesis to that of arene oxides

Previous attempts to prepare polycyclic mono-imines were unsuccessful [4-6] Arene imines were proposed to be reaction intermediates in the syntheses of aryl carbamates from ethyl azidoformate and naphthalene,[4] anthracene,[5,6] phenanthrene[5] and pyrene[5], but proved impossible to isolate Under mild conditions naphthalene is reported to give some tetrahydronaphtho[1,2-b 3,4 b']bisazirine free of any monoaziridine derivative [7]

We now wish to report two general syntheses of polycyclic arene imines one which might be particularly useful for the introduction of an epimine function in a terminal ring, and one for preparation of so-called K region epimines

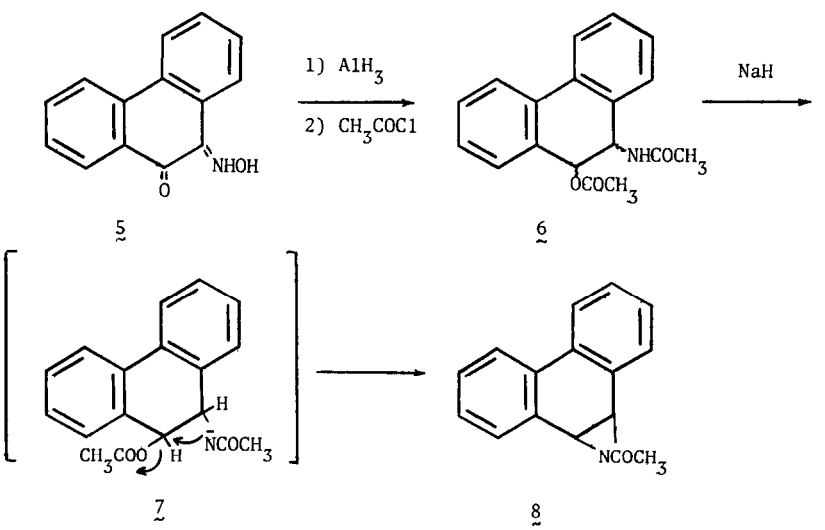


1 2 3 4

1a,2,3,7b-Tetrahydro-1H-napth[1,2-b]azirine (1, R=H) (prepared according to Heathcock and Hassner[8]) was acetylated at 0° with acetyl chloride in the presence of Et_3N to give 1, R=$COCH_3$ in quantitative yield[9], bp 84° (0 02 mm)[10], ir (C=O) 1675 cm^{-1}, uv (CH_3CN) 228 mμ (ε 7200) Subsequent bromination (NBS) afforded 2, R=$COCH_3$, δ (CCl_4) 5 46 (t, 1H, CHBr), mass spectrum (70 ev) 269, 267, 223, 225, 185, 183, 128 (base peak) The crude bromide (admixed with some oxazoline 4) was dehydrobrominated by stirring a THF solution (10 mmoles in 30 ml) with 1,5-diazabicyclo[4 3 0]nona-5-ene (2 ml) for 24 hr at -30 to -10° to yield 25% of

1-acetyl-1a,7b-dihydronapth[1,2-b]azirine (3, R=$COCH_3$) as a colorless oil Mass spectrum (70 ev 185, 183, 142, 128 (base peak), ir (C=O) 1665 cm^{-1}, no NH absorption appears in the ir spectrum, uv (CH_3CN) 242 mμ (ε 10800) The nmr spectrum resembles that of oxireno[a]naphthalene[11] δ (CCl_4) 1 46 (s, 3H), 4 83 (1H, $J_{1a,7b}$=8 cps $J_{1a,2}$=4 cps $J_{1a,3}$=1 8 cps), 5 51 (d, 1H, $J_{1a,7a}$=8 cps), the vinylic protons form an ABX pattern 5 82 (d, 1H, $J_{2,3}$=10 cps, $J_{1a,2}$=4 cps), 6 30 (d,d, 1H, $J_{2,3}$=10 cps, $J_{1a,3}$=1 8 cps), 7 03-7 34 (m, 4H) These data exclude the possibility of either ring cleavage of the aziridine structure to give 1- and 2-naphthylamine derivatives, or its expansion to the corresponding acetylbenzazepines The imine 3, R=$COCH_3$ reacts readily with 1,3-diphenylisobenzofuran

The method of preparation of K-substituted arene imines was demonstrated by the synthesis of 1-acetyl-1a,9c-dihydrophenanthr[9,10-b]azirine(8)



5 6 7 8

9,10-Phenanthrenequinone monoxime (5) was reduced with the required amount of a 2M solution of aluminium hydride in THF[12] Acetylation of the amino-alcohol, so formed, led to compound 6[9], ir (Nujol) 1645, 1732 cm^{-1} (amide and ester CO, respectively) Ring closure to 8 was afforded in 64% yield by addition of a suspension of 6 (10 mmoles in 150 ml benzene) to an equimolar amount of NaH in the same solvent (200 ml) under N_2 followed by reflux for 30 min Alternatively 8 was obtained in < 10% yield when a THF solution of 6 (10 mmoles in 50 ml) was treated at -78° with 2M etheral solution of CH_3Li (5 ml) and the mixture refluxed for 30 min The imine[9] rearranges to 9-acetylaminophenanthrene (of mp 197 [13]) below the mp,

ir (Nujol)(C=O) 1652 cm^{-1}, uv (EtOH) 256 mμ (ε 40000), δ ($CDCl_3$) 1 92 (s, 3H), 2 30 (s, 2H), 8 10-7 35 (m, 6H), 8 66 (m, 2H) The mass spectrum provides most convincing evidence for the structure of 8 The major peaks are 235 $[M]^+$, 193 $[M-COCH_3]^+$, and the typical fluorenyl fragment of the 9,10-dihydrophenanthrene system of m/e = 165 [14] The absence of phenanthrene fragmentation is remarkable While no NH proton shows up in the nmr spectrum of freshly prepared 8, the characteristic features of an aromatic amide slowly appear when the aziridine is left in $CDCl_3$ for several hours at room temperature After four days the entire aziridine has rearranged into N-acetyl-9-phenanthrylamine[13]

Syntheses of arene imines derivatives of some carcinogenic polycyclic hydrocarbons by these two methods are now in hand

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formation of azirıdıne-free 2,3,4,5-tetrahydro-1H-2-benzazepıne [ıdentıfıed by comparıson wıth an authentıc sample, G Schroeter, A Gluschke, S Götzky, J Huang, G Irmısch, E Laves, O Schrader and G Stıer, Ber dtsch chem Ges, 63, 1308 (1930)], m/e=147 $[M]^+$ The N-benzoyl derıvatıve, mp 98°, m/e=251 $[M]^+$

9) All new compounds have satısfactory elementary analyses of C, H and N (wıthın ± 0 3% of the theoretıcal values)

10) When 1, R=$COCH_3$ ıs heated above 130° for 30 mın complete ısomerızatıon to the oxazolıne 4 takes place, bp 135° (1 2 mm), δ ($CDCl_3$) 1 88 (s, 3H), 2 02 (m, 2H), 2 60 (t, 2H), 4 47 (m, 1H), 5 44 (d, 1H, J = 10 cps), 7 00-7 36 (m, 4H)

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