Allenes. Part 46.[1] Synthesis of 1,2-Dihydro-4*H*-3,1-benzoxazines, 4*H*-3,1-Benzoxazines, and 3-Cyanoquinolines from Allenic and Acetylenic Nitriles

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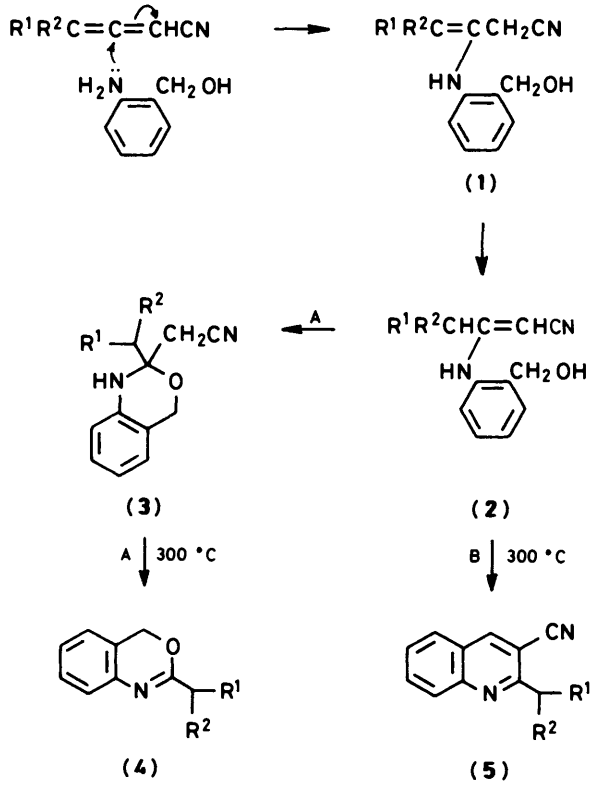
Allenic nitriles or phenylpropynenitrile react in refluxing ethanol with *o*-aminobenzyl alcohol to give first enaminic nitriles (**2**) which slowly cyclise to dihydro-4*H*-3,1-benzoxazines (**3**). The latter eliminate acetonitrile on heating to give 4*H*-3,1-benzoxazines (**4**) whereas the enaminic nitriles under the same conditions give mainly 2-alkyl-3-cyanoquinolines (**5**). Mechanistic considerations and spectroscopic details are discussed.

Benzoxazines have been shown to possess interesting pharmacological properties.[2-4] We have investigated a possible synthetic route to the benzoxazines (**4**) from allenic nitriles and *o*-aminobenzyl alcohol as outlined in Scheme 1.

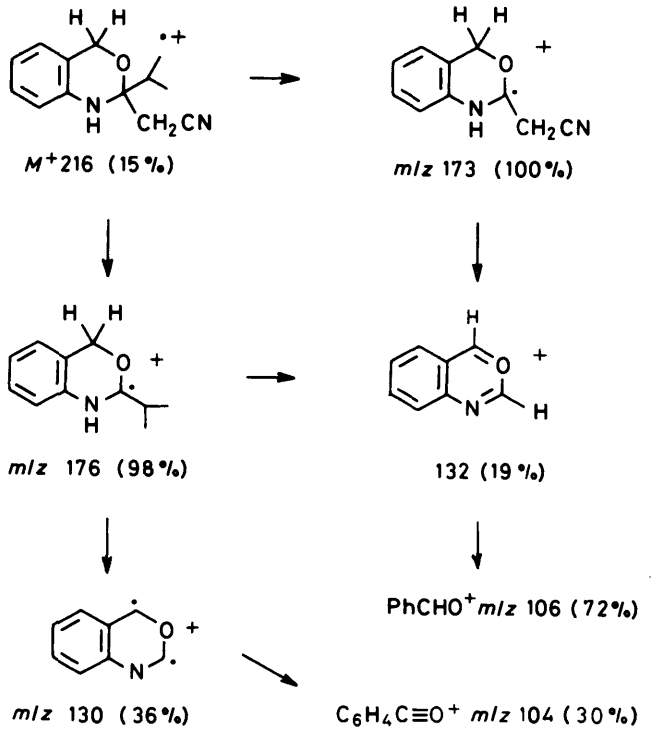


a ; R^1 = Pr, R^2 = H
b ; R^1 = Me, R^2 = Me
c ; R^1 = Me, R^2 = Et
d ; R^1 = Et, R^2 = Et

Scheme 1.

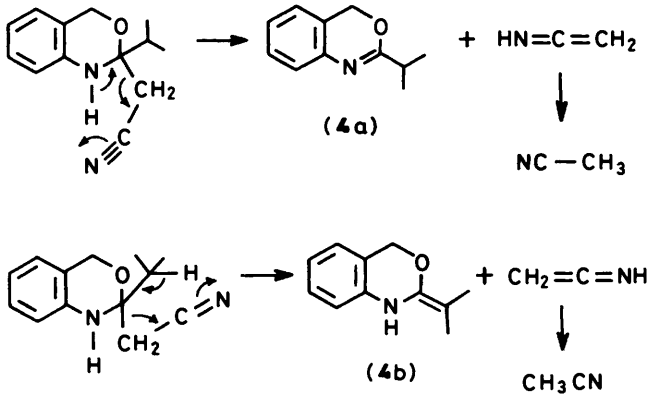
o-Aminobenzyl alcohol, in refluxing ethanol, added slowly to the central carbon of the allenic nitrile.[5,6] Examination of the crude product (by chromatography and spectroscopy) indicated that a mixture of the conjugated 2-enenitrile (**2**) and the cyclised dihydro-4*H*-3,1-benzoxazine (**3**) had been formed in each case, the relative amount of the adduct (**2**) and heterocycle (**3**) varying with the time of reflux and the substituents on the allene. After 50—70 h reflux in ethanol, the principal product was the adduct (**2**), shorter times resulting in recovery of some starting material and traces of the unconjugated adduct (**1**). After 100 h the main product was the dihydro-oxazine (**3**) and this became the only product after reflux in ethanol for 8 days.[7] Cyclic intermediates such as (**3**), resulting from a double Michael addition of a dinucleophile to an allenic nitrile have been postulated by us as occurring in the synthesis of other heterocyclic systems but had hitherto not been isolated or identified.[1,5,6,8,9]

The isomeric enaminic adducts (**2**) and dihydrobenzoxazines (**3**) are readily distinguished by their spectroscopic data. The adducts (**2**) have twin peaks at *ca.* 3 260 and 3 380 cm^{-1} for the NH and OH groups as well as an intense peak just below 2 200 cm^{-1} for the conjugated nitrile (NH–CH=CH–CN) whereas the dihydrobenzoxazines (**3**) show a single peak at 3 250 cm^{-1} for



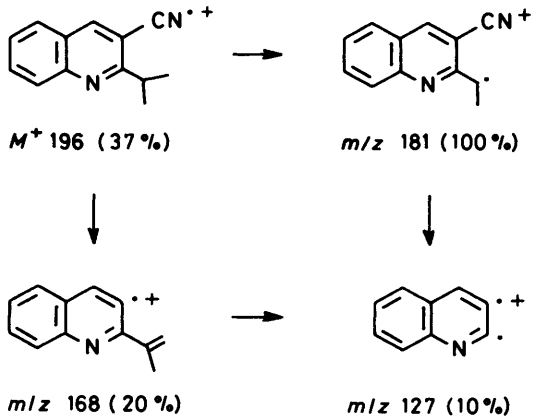
Scheme 2.

the NH group and a less intense peak at 2 250 cm^{-1} for the methylenenitrile (CH_2CN) in the i.r. spectrum. In the u.v. spectrum the maximum at longest wavelength for adducts (**2**) is an intense band at $\lambda_{max.}$ 275 nm whereas the dihydrobenzoxazines show a broad, low intensity peak at *ca.* 300 nm with a minimum at *ca.* 270 nm. Diagnostic signals in the n.m.r. are a 1 H singlet for the shielded alkenic proton at about δ 4.20 typical of the *E*-isomer of the enaminic adduct (**2**)[5] and a 2 H singlet corresponding to CH_2CN at δ 2.62 in the dihydrobenzoxazine (**3**). The mass spectral fission pattern confirmed the structure of (**3**) (Scheme 2). The molecular ion (for the isopropyl side-chain *m/z* 216, 15%) loses isopropyl to give the base peak (*m/z* 173, 100%) or alternatively loses the acetonitrile radical to give the intense peak (*m/z* 176, 98%). Both fragments degrade further by loss of the remaining side-chain to give peaks at *m/z* 132 (19%) and 130 (36%). The intense peak at *m/z* 106 (72%) could result from loss of HCN and transfer of hydrogen and this loses CO to give the benzene radical ion (*m/z* 77, 35%). The dihydrobenzoxazines are readily converted into the corresponding benzoxazines (**4**) in about 80% yield on heating to 250—270 °C for 10 min followed by distillation. Elimination of acetonitrile by two competing, concerted mechanisms is possible (Scheme 3).[1] However we have no evidence that compound (**4b**) is present in the product.



Scheme 3.

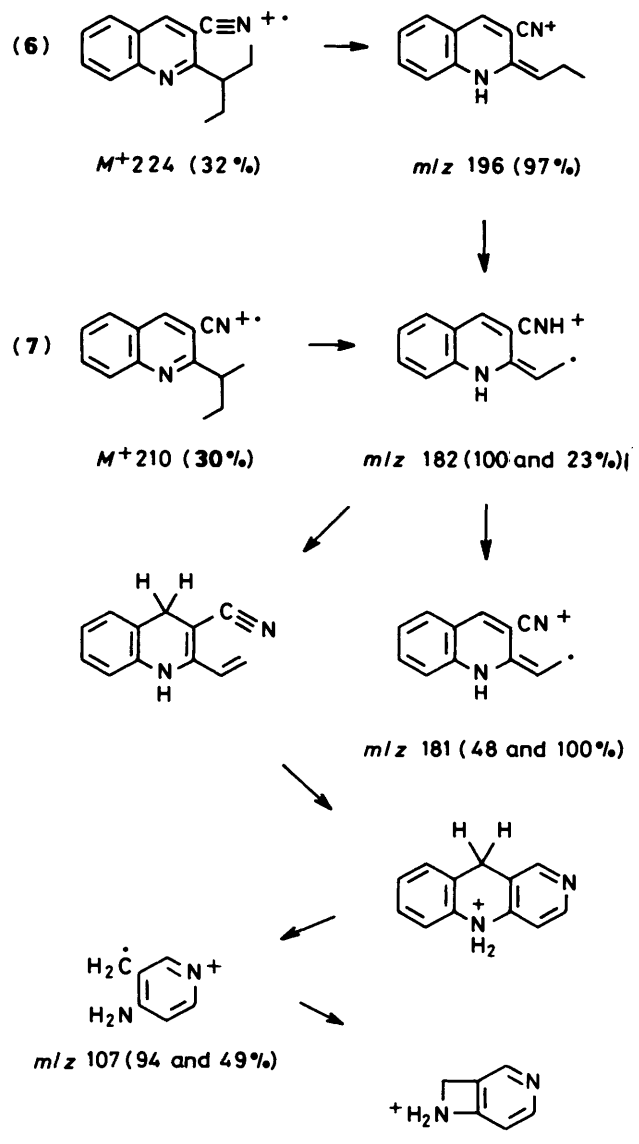
When the enaminic nitrile adducts (**2**) containing small quantities of the dihydrobenzoxazines (**3**) (from the reflux of ethanolic solutions of starting materials for 50—70 h) were heated at 300 °C and distilled, two products were obtained, the minor product being the benzoxazine (**4**). The major product showed a nitrile band in the i.r. near 2 220 cm^{-1} and an n.m.r.



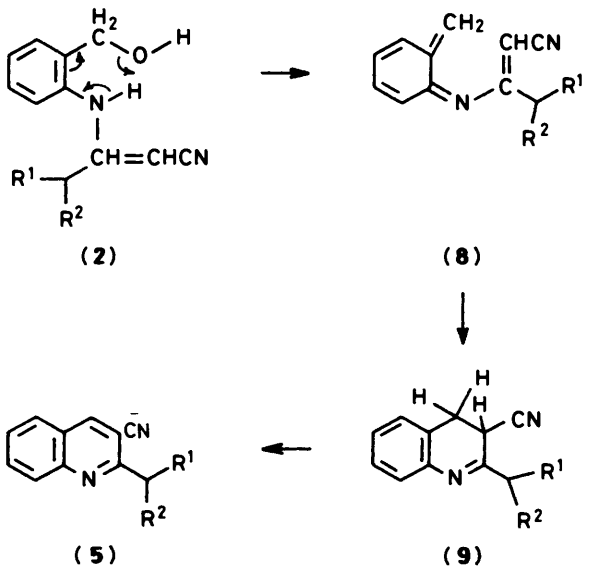
signal at δ 8.42 typical of a strongly deshielded proton at the 4-position of a 3-cyanoquinoline.[10] The mass spectra are rationalised as follows M^+ (for an isopropyl side-chain) at *m/z* 196 (37%) loses a methyl radical to give the base peak at *m/z* 181 (100%). Alternatively, M^+ 196 gives *m/z* 168 (20%) by elimination of HCN and H', which loses the side-chain (−41) to give *m/z* 127 (10%) which also results from loss of ethene and HCN from *m/z* 181. Finally the *m/z* 127 fragment degrades to the phenylacetylene radical (*m/z* 101, 5%) and then the benzene radical ion (*m/z* 77, 7%). 2-(1-Methylpropyl) and 2-(1-ethylpropyl)-3-cyanoquinolines (**7**) and (**6**) give the expected McLafferty rearrangement followed by an unusual electrocyclic reaction, hydrogen transfer and loss of benzene to give the 4-amino-3-methylpyridine ion, *m/z* 107.

The 2-alkyl-3-cyanoquinolines are obtained in 60—70% yield, thus affording access to these little known heterocycles.

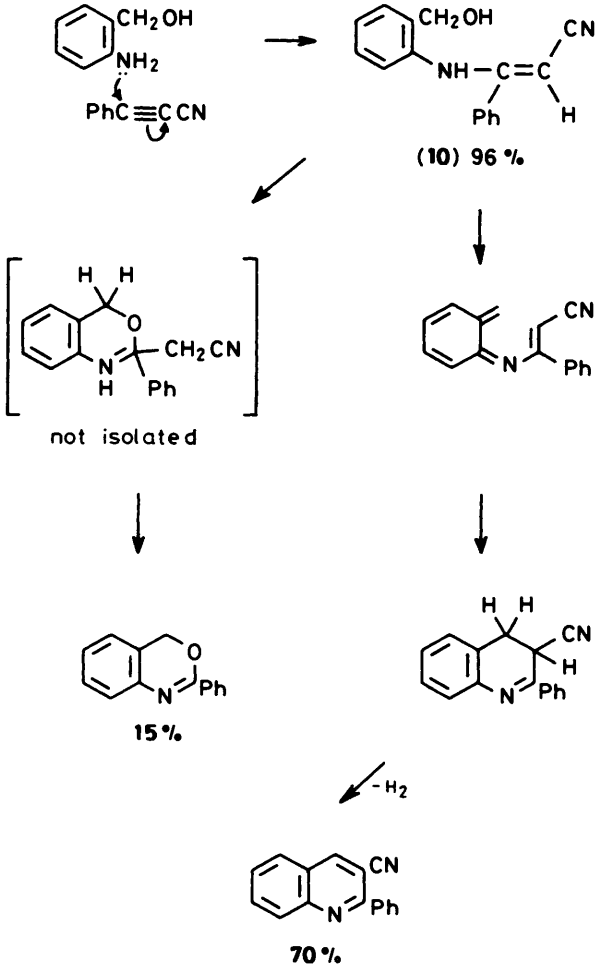
The reaction must proceed through three stages from the



adduct (**2**): (1) dehydration; (2) ring closure; and (3) dehydrogenation. A number of mechanistic schemes can be envisaged, the following (Scheme 4) being the most plausible, taking into consideration that we are dealing with a pyrolytic



conversion in the absence of a polar solvent. Dehydration of the enaminic nitrile (**2**) gives the unstable triene (**8**) which undergoes a fast thermal electrocyclic reaction (disrotatory) to the dihydroquinoline (**9**) and then a *cis*-elimination of hydrogen



Scheme 5.

to give the 2-alkyl-3-cyanoquinoline (**5**). The n.m.r. of the crude products shows the presence of some dihydroquinoline (**9**).

In order to investigate a similar reaction of acetylenic nitriles, phenylpropynenitrile was heated under reflux with *o*-aminobenzyl alcohol in alcoholic solution for 62 h which resulted in the crystalline adduct (**10**) in 96% yield. The adduct (**10**) was heated at 260—270 °C for 20 min and was distilled to yield 2-phenyl-4*H*-3,1-benzoxazine (15%) as an oil and 2-phenyl-3-cyanoquinoline (70%) as white crystals thus demonstrating the general applicability of this reaction sequence to acetylenic nitriles.*

Experimental

I.r. spectra were determined with a Perkin-Elmer 337 spectrophotometer. U.v. spectra were determined for ethanolic solutions with a Beckman 25 spectrophotometer. N.m.r. spectra were determined with a Perkin-Elmer R12A spectrophotometer for solutions in deuteriochloroform unless otherwise stated, with tetramethylsilane as the internal standard. The allenic nitriles and phenylpropyne nitrile were prepared as previously described.[7] Commercial 2-aminobenzyl alcohol was recrystallised from ethanol–methylene dichloride until it gave one spot on t.l.c.

*2-Butyl-2-cyanomethyl-1,2-dihydro-*4H*-3,1-benzoxazine* (**3a**).—(*a*) 2-Aminobenzyl alcohol (3.7 g, 30 mmol) and hepta-2,3-dienenitrile (3.2 g, 30 mmol) were dissolved in ethanol and refluxed with stirring for 100 h. A sample of the reaction was checked by t.l.c. which indicated traces of starting material and the formation of two new compounds. Removal of the solvent under reduced pressure gave a crude product (6.8 g) as an oil and part of this material (2.5 g) was chromatographed on alumina (300 g, activity 3). Elution with hexane–ethyl acetate (9:1) gave *2-butyl-2-cyanomethyl-1,2-dihydro-*4H*-3,1-benzoxazine* (1.9 g, 76%) (Found: C, 73.0; H, 7.85; N, 12.25. $C_{14}H_{18}N_2O$ requires C, 73.04; H, 7.82; N, 12.17%); $\nu_{max.}$ 3 250 (NH) and 2 260 cm^{-1} (C≡N); $\lambda_{max.}$ 208, 246, and 298 nm (ε 22 800, 13 400, and 3 000 dm^3 mol^{-1} cm^{-1}); δ_H 0.85 (3 H, t, *Me*CH_2), 1.15—1.55 (4 H, m, MeCH_2CH_2), 1.52—1.82 (2 H, m, CH_2C), 2.62 (2 H, s, CH_2CN), 4.25 (1 H, br s, NH, exchanges D_2O), 4.75 (2 H, s, CH_2O), and 6.50—7.15 (4 H, m, ArH).

Elution with hexane–ethyl acetate (8:2) gave (after re-chromatography) *3-(2-hydroxymethylanilino)hept-2-enenitrile* (**2a**) (0.5 g, 7%) (Found: C, 73.2; H, 7.7; N, 12.3. $C_{14}H_{18}N_2O$ requires C, 73.04; H, 7.83; N, 12.17%); $\nu_{max.}$ 3 350—3 250 (OH, NH), 2190 (CN), and 1 590 cm^{-1} (C=C); $\lambda_{max.}$ 205, 339, and 277 nm (ε 12 000, 9 000, and 8 000 dm^3 mol^{-1} cm^{-1}); δ_H 0.80 (3 H, t, *Me*CH_2), 1.10—1.70 (4 H, m, MeCH_2CH_2), 2.30 (2 H, t, CH_2C=), 3.40 (1 H, br s, OH, disappears on deuteriation), 4.20 (2 H, s, CH_2OH), 4.60 (1 H, s, =CHCN), 6.20—7.20 (4 H, m, ArH), and 8.00 (1 H, s, NH, exchanges D_2O).

(*b*) *o*-Aminobenzyl alcohol (0.62 g, 5 mmol) and hepta-2,3-dienenitrile (0.54 g, 5 mmol) were allowed to react as in (*a*) but for an extended reaction time of 150 h. Chromatography of the reaction product gave the dihydro-4*H*-3,1-benzoxazine (**3a**) (0.93 g, 80%) with identical spectroscopic properties to the compound obtained in (*a*).

*2-Butyl-*4H*-3,1-benzoxazine* (**4a**).—Part of the crude mixture (4.3 g) consisting mainly of 2-butyl-2-cyanomethyl-1,2-dihydro-4*H*-3,1-benzoxazine (**3a**) obtained above was heated at 300 °C. A distillate was collected which was dissolved in methylene

* Acetylenic nitriles with different substituents give the same reactions as phenylpropynenitrile, S. R. Landor and R. Roberts, unpublished work.

dichloride (200 ml), washed with water (3 × 60 ml) and dried (Na_2SO_4). Removal of the solvent and distillation of the residue gave *2-butyl-4H-3,1-benzoxazine* (2.7 g, 78%), b.p. 165 °C at 760 mmHg (Found: C, 75.95; H, 7.7; N, 7.25. $C_{12}H_{15}NO$ requires C, 76.19; H, 7.93; N, 7.40%); $\nu_{max.}$ 1 620 cm^{-1}; $\lambda_{max.}$ 206, 235, and 286 (ε 17 400, 10 900, and 1 900 dm^3 mol^{-1} cm^{-1}); δ 0.92 (3 H, t, *Me*CH_2), 1.2—1.8 (4 H, m, MeCH_2-CH_2CH_2), 2.22 (2 H, t, CH_2CH_2), 4.22 (2 H, s, CH_2O), and 6.6—7.4 (4 H, m, ArH). A second fraction (0.4 g), which contained 2-butyl-3-cyanoquinoline and benzoxazine, was not purified further.

2-Cyanomethyl-2-isopropyl-1,2-dihydro-4H-3,1-benzoxazine (**3b**).—2-Aminobenzyl alcohol (4.92 g, 0.04 mol) and 4-methylpenta-2,3-dienenitrile (3.72 g, 0.04 mol) in ethanol (165 ml) heated under reflux for 144 h and evaporated to dryness. A portion (3 g) was chromatographed on silica gel (125 g) and eluted with hexane–chloroform (9:1) to give 2-cyanomethyl-2-isopropyl-1,2-dihydro-4*H*-3,1-benzoxazine (2.34 g, 78%), m.p. 57—58 °C (Found: C, 72.2; H, 7.5; N, 12.75. Calc. for $C_{13}H_{16}N_2O$: C, 72.22; H, 7.40; N, 12.96%); $\nu_{max.}$ 3 250 (NH) and 2 260 cm^{-1} (C≡N); $\lambda_{max.}$ 209, 246, and 298 nm (ε 21 600, 11 200, and 2 400 dm^3 mol^{-1} cm^{-1}); δ 1.06 (6 H, d, Me_2CH), 2.23 (1 H, septet, Me_2CH), 2.73 (2 H, s, CH_2CN), 4.21 (1 H, br s, N*H*, exchanges D_2O), 4.75 (2 H, s, CH_2O), and 6.5—7.2 (4 H, m, ArH).*

2-Isopropyl-4H-3,1-benzoxazine (**4b**) *and 3-Cyano-2-isopropylquinoline* (**5b**).—The crude mixture (5.3 g, obtained above) was distilled slowly, bath temp. 300—320 °C, to give 2-isopropyl-4*H*-3,1-benzoxazine (3.4 g, 80%), b.p. 130 °C at 760 mmHg (Found: C, 75.8; H, 7.2; N, 7.7. $C_{11}H_{13}NO$ requires C, 75.42; H, 7.42; N, 7.40%); $\lambda_{max.}$ 205, 235, and 286 nm (ε 16 200, 11 300, and 2 000 dm^3 mol^{-1} cm^{-1}); δ 1.19 (6 H, d, Me_2CH), 2.3 (1 H, septet, C*H*Me_2), 4.85 (2 H, s, CH_2O), and 6.6—7.4 (4 H, m, ArH). Also isolated as a white crystalline solid in the condenser was *3-cyano-2-isopropylquinoline* (0.7 g, 13%), m.p. 96—98 °C (Found: C, 79.6; H, 5.9; N, 14.4. $C_{13}H_{12}N_2$ requires C, 79.59; H, 6.12; N, 14.29%); $\nu_{max.}$ 2 200 cm^{-1} (C≡N); $\lambda_{max.}$ 214, 241, and 280 nm (ε 30 500, 24 000, and 4 200 dm^3 mol^{-1} cm^{-1}); δ 1.13 (6 H, d, Me_2CH), 3.64 (1 H, septet, C*H*Me_2), 7.3—8.2 (4 H, m, ArH), and 8.45 (1 H, s, N=C–C=CH).

2-(1-Methylpropyl)-4H-3,1-benzoxazine (**4c**) *and 3-Cyano-2-(1-methylpropyl)quinoline* (**5c**).—2-Aminobenzyl alcohol (4.92 g, 0.04 mol) and 4-methylpenta-2,3-dienenitrile (4.28 g, 0.04 mol) in ethanol (80 ml) were heated under reflux for 66 h to give, after chromatography, recovered allenic nitrile (0.4 g, 9%), impure 2-cyanomethyl-2-(1-methylpropyl)-2,3-dihydro-4*H*-3,1-benzoxazine (**3c**) [contaminated by the adduct (**2c**)] (2.7 g, 27%) and 3-(2-hydroxymethylanilino)-4-methylhex-2-enenitrile (**2c**) (5.85 g, 64%) (Found: C, 73.21; H, 8.04; N, 12.11. $C_{14}H_{18}N_2O$ requires C, 73.04; H, 7.83; N, 12.17%); $\nu_{max.}$ 3 400 (OH) and 3 280 cm^{-1} (NH); $\lambda_{max.}$ 207, 244, and 274 nm (ε 15 500, 8 400, and 8 000 dm^3 mol^{-1} cm^{-1}); δ 0.98 (3 H, t, *Me*CH_2), 1.4 (3 H, d, CH*Me*), 1.59 (2 H, quintet, CHCH_2Me), 2.80 (1 H, br s, OH), 2.86 (1 H, sextet, CH_2CHMe), 4.30 (1 H, s, =CH), 4.51 (2 H, s, CH_2OH), 7.2 (1 H, br s, NH, exchanges D_2O), 6.7—7.3 (4 H, m, ArH); *m/z* 230 (M^+). The crude mixture (7 g) was distilled (bath temp. 300—310 °C) to give *2-(1-methylpropyl)-4H-3,1-benzoxazine* (**4c**) (1.8 g, 31%), b.p. 158 °C at 760 mmHg (Found: C, 76.45; H, 8.25; N, 7.8. $C_{12}H_{15}NO$ requires C, 76.19; H, 7.93; N, 7.40%); $\lambda_{max.}$ 203, 234, and 284 nm (ε 17 300, 11 800, and 2 600 dm^3 mol^{-1} cm^{-1}); δ 0.90 (3 H, t, *Me*CH_2), 1.14 (3 H, d, CH*Me*), 2.1 (1 H, sextet, CH_2CHMe), 4.40 (2 H, s, CH_2OH), and 6.6—7.4 (4 H, m, ArH). A second fraction, *3-cyano-2-(2-methylpropyl)quinoline* (**5c**), was also obtained (3.7 g, 58%), b.p. 180 °C at 760 mmHg (Found: C, 79.9; H, 6.6; N, 13.6. $C_{14}H_{14}N_2$ requires C, 80.0; H, 6.67; N, 13.33%); $\nu_{max.}$ 2 215 cm^{-1} (C≡N); $\lambda_{max.}$ 214, 243, and 280 nm (ε 21 800, 27 800, and 3 000 dm^3 mol^{-1} cm^{-1}); δ 0.92 (3 H, t, *Me*CH_2), 1.42 (3 H, d, CH*Me*), 1.85 (2 H, quintet, MeCH_2), 3.55 (1 H, sextet, CH_2CHMe), 7.3—8.2 (4 H, m, ArH), and 8.44 (1 H, s, N≡C–C≡C*H*).

2-Cyanomethyl-2-(1-ethylpropyl)-1,2-dihydro-4H-3,1-oxazine (**3d**).—2-Aminobenzyl alcohol (3.69 g, 0.03 mol) and 4-ethylhexa-2,3-dienenitrile (3.63 g, 0.03 mol) in ethanol (100 ml) refluxed for 50 h gave, after chromatography, *3-ethyl-3-(2-hydroxymethylanilino)hex-2-enenitrile* (**2d**) (5.56 g, 76%), m.p. 122 °C (Found: C, 73.5; H, 8.1; N, 11.25. $C_{15}H_{20}N_2O$ requires C, 73.77; H, 8.20; N, 11.47%); $\nu_{max.}$ 3 360 (OH), 3 250 (NH), and 2 190 cm^{-1} (CN); $\lambda_{max.}$ 207, 238, and 276 nm (ε 10 900, 7 500, and 10 200 dm^3 mol^{-1} cm^{-1}); δ 0.99 (6 H, t, 2 × *Me*CH_2), 1.59 (4 H, quintet, 2 × CH_2Me), 2.40 (1 H, s, OH, exchanges D_2O), 2.78 (1 H, quintet, CH_2CHCH_2), 4.48 (1 H, s, C=CH), 4.57 (2 H, s, CH_2OH), and 6.8—7.4 (5 H, m, ArH and NH; latter exchanges D_2O).

3-Ethyl-3-(2-hydroxymethylanilino)hex-2-enenitrile (**2d**) (1.22 g, 5 mmol) refluxed for 140 h in ethanol (10 ml) gave, after chromatography of the reaction product, *2-cyanomethyl-2-(1-ethylpropyl)-1,2-dihydro-4H-3,1-benzoxazine* (**3d**) (1.0 g, 82%), m.p. 42 °C (Found: C, 73.8; H, 8.15; N, 11.68. $C_{15}H_{20}N_2O$ requires C, 73.77; H, 8.20; N, 11.47%); $\nu_{max.}$ 3 250 (NH) and 2 250 cm^{-1} (CN); $\lambda_{max.}$ 210, 246, and 298 (ε 23 400, 13 800 and 3 100 dm^3 mol^{-1} cm^{-1}); δ 0.94 (6 H, t, 2 × *Me*CH_2), 1.40 (4 H, quintet, 2 × MeCH_2), 2.15 (1 H, quintet, CH_2CHCH_2), 2.60 (2 H, s, CH_2CN), 4.35 (1 H, br s, NH, exchanges D_2O), 4.75 (2 H, s, CH_2O), and 6.5—7.2 (4 H, m, ArH).

2-(1-Ethylpropyl)-4H-3,1-benzoxazine (**4d**).—2-Cyanomethyl-2-(1-ethylpropyl)-1,2-dihydro-4*H*-3,1-benzoxazine (0.9 g) was distilled at 250 °C to give *2-(1-ethylpropyl)-4H-3,1-benzoxazine* (0.6 g, 80%), b.p. 165 °C at 760 mmHg (Found: C, 76.7; H, 8.6; N, 7.2. $C_{13}H_{17}NO$ requires C, 76.84; H, 8.37; N, 6.90%); $\lambda_{max.}$ 204, 230, and 284 (ε 15 000, 13 000, and 2 800 dm^3 mol^{-1} cm^{-1}); δ 0.82 (6 H, t, 2 × *Me*CH_2), 1.85 (4 H, quintet, MeCH_2CH), 2.11 (1 H, quintet, CH_2CHCH_2), 4.04 (2 H, s, CH_2O), and 6.5—7.3 (4 H, m, ArH).

3-Cyano-2-(1-ethylpropyl)quinoline (**5d**).—4-Ethyl-3-(2-hydroxymethylanilino)hex-2-enenitrile (4.8 g, 0.019 mol) was heated at bath temp. 300—310 °C and distilled to give first benzoxazine (1.2 g, 30%) and secondly *3-cyano-2-(1-ethylpropyl)quinoline* (2.9 g, 66%), b.p. 184 °C at 760 mmHg (Found: C, 80.1; H, 7.0; N, 12.3. $C_{15}H_{16}N_2$ requires C, 80.35; H, 7.14; N, 12.50%); $\nu_{max.}$ 2 220 cm^{-1}; $\lambda_{max.}$ 215, 243, and 280 (ε 22 700, 29 000, and 3 100 dm^3 mol^{-1} cm^{-1}); δ 0.84 (6 H, t, 2 × *Me*CH_2), 1.88 (4 H, quintet, 2 × MeCH_2), 3.25 (1 H, quintet, CH_2CHCH_2), 7.1—8.2 (4 H, m, ArH), and 8.44 (1 H, s, N=C–C=CH).

2-Phenyl-4H-3,1-benzoxazine and 3-Cyano-2-phenylquinoline.—2-Aminobenzyl alcohol (3.69 g, 0.03 mol) and 3-phenylpropynenitrile (3.81 g, 0.03 mol) refluxed in ethanol (125 ml) for 62 h gave crystalline *3-(2-hydroxymethylanilino)-3-phenylprop-2-enenitrile* (**10**) (7.2 g, 96%), m.p. 137 °C (Found: C, 76.75; H, 5.3; N, 11.15; M^+, 250. $C_{16}H_{14}N_2O$ requires C, 76.80; H, 5.60; N, 11.20%; M^+, 250); $\nu_{max.}$ 3 400 (OH), 3 210 (NH), and 2 195 cm^{-1} (CN); $\lambda_{max.}$ 203, 240, and 300 (ε 29 800, 13 700, and 5 900); δ(Me_2SO–$CDCl_3$) 2.70 (1 H, br s, OH,

* The diastereotopic methyl groups and protons in this chiral 1,2-dihydro-4*H*-3,1-benzoxazine do not show non-equivalence on the 60 MHz n.m.r. spectrum as the shielding effect of the oxygen and nitrogen are nearly equivalent [1] and both differential chemical shifts and coupling constants are too small for resolution.

exchanges D_2O), 4.38 (1 H, s, =CHCN), 5.57 (2 H, s, CH_2OH), 7.0—7.8 (4 H, m, ArH), and 7.70 (1 H, br s, NH).

3-(2-Hydroxymethylanilino)-3-phenylprop-2-enenitrile (5.2 g, 0.02 mol) heated for 20 min and distilled at 260—270 °C gave 2-*phenyl*-4H-3,1-*benzoxazine* (0.6 g, 14%), b.p. 206 °C at 760 mmHg (Found: C, 79.2; H, 5.6; N, 6.3. $C_{14}H_{11}NO$ requires C, 80.40; H, 5.26; N, 6.70%); δ 4.05 (2 H, s, CH_2O) and 6.50—7.70 (9 H, m, ArH) and 3-*cyano*-2-*phenylquinoline* (3.4 g, 74%), m.p. 186 °C (Found: C, 83.55; H, 4.5; N, 12.35. $C_{16}H_{10}N_2$ requires C, 83.47; H, 4.43; N, 12.17%); $\nu_{max.}$ 2 220 cm^{-1} (CN); $\lambda_{max.}$ 213, 241, and 260 nm (ε 29 000, 34 900, and 35 400 dm^3 mol^{-1} cm^{-1}); δ 7.2—8.3 (9 H, m, ArH), and 8.62 (1 H, s, N=C–C=C*H*).

Acknowledgements

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References

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