Allenes. Part 47.[1] Pyrido[1,2-*a*]pyrimidines and their Hydrolysis Products from Allenic and Acetylenic Nitriles

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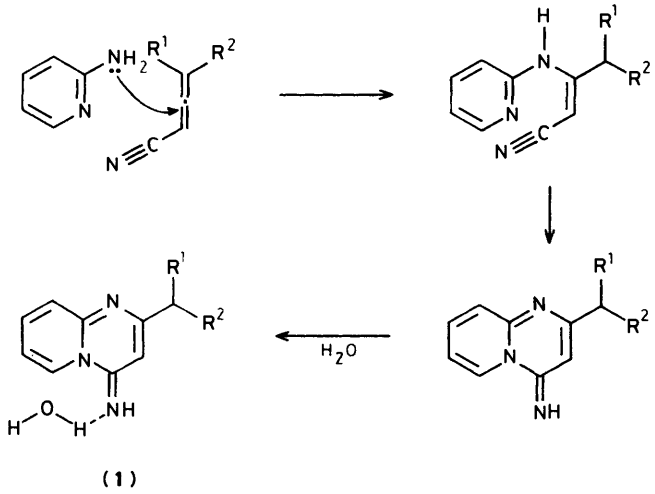
The reactions between 2-aminopyridine, *C*-substituted 2-aminopyridines, and allenic nitriles or phenylpropynenitrile give, initially, 2-amino-2*H*-pyrido[1,2-*a*]pyrimidines which are moderately stable under acidic conditions but undergo addition of water with extreme ease under basic conditions to form 4-hydroxypyrido[1,2-*a*]pyrimidines. These undergo ring cleavage when refluxed in ethanol to pyridyl ketones (**5**).

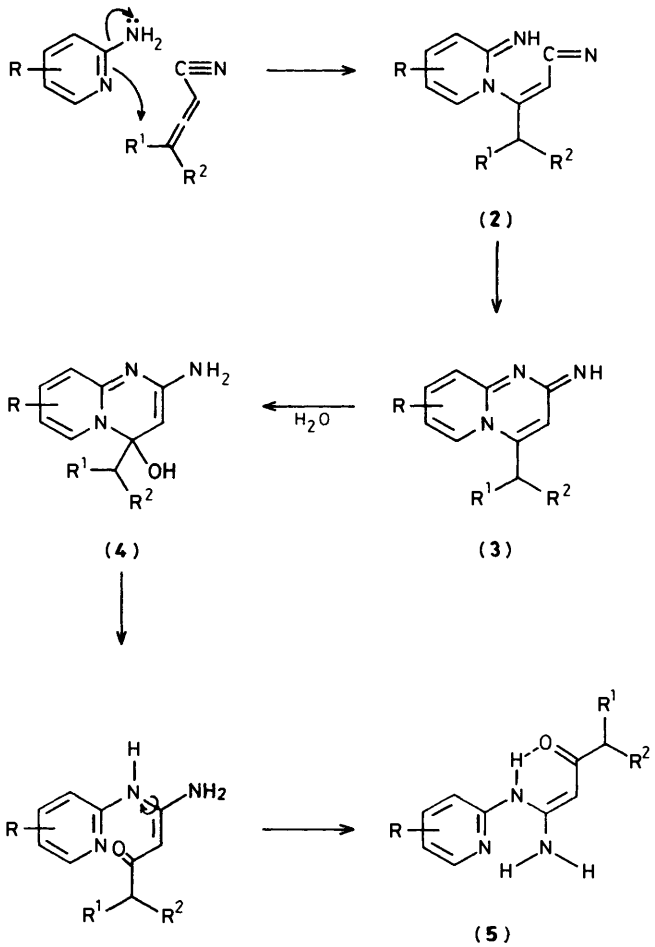
Pyrido[1,2-*a*]pyrimidin-4-ones possess antiatherosclerotic, antipyretic, and analgesic and analgetic properties.[2] We recently reported in a preliminary publication[3] that the reaction between 2-aminopyridines and allenic nitriles usually gave monohydrates of the closely related 4-aminopyrido[1,2-*a*]-pyrimidines (**1**) and, in special cases, 2-iminopyrido[1,2-*a*]-pyrimidines (**3**).[4] The assignment of structure (**1**) was based mainly on a comparison of u.v. spectra and, mechanistically, on the initial attack of the side-chain amino group on the central carbon of the allene (Scheme 1).



Scheme 1.

Later, detailed ^1H and ^{13}C n.m.r. and mass spectral data led to the conclusion that 2-iminopyridopyrimidines were always formed initially by prior attack of the ring nitrogen[4,5] on the central carbon of the allene to give the adduct (**2**) which then underwent ring closure by nucleophilic attack of the side-chain nitrogen on the carbon of the nitrile. Water added at the 4-position of the pyrimidine ring and subsequent ring cleavage gave the pyridyl ketones (**5**) (Scheme 2).

The pyridyl ketones (**5**) were obtained after refluxing the reagents in 95% ethanol for 70—150 h (the reaction being monitored by t.l.c.), followed by chromatography and were identified as follows: elemental analyses and molecular ions (M^+) are correct for $C_8H_8N_3OX$ (C_nH_{2n+1}) (X = substituent on the pyridine ring; C_nH_{2n+1} = alkyl group derived from

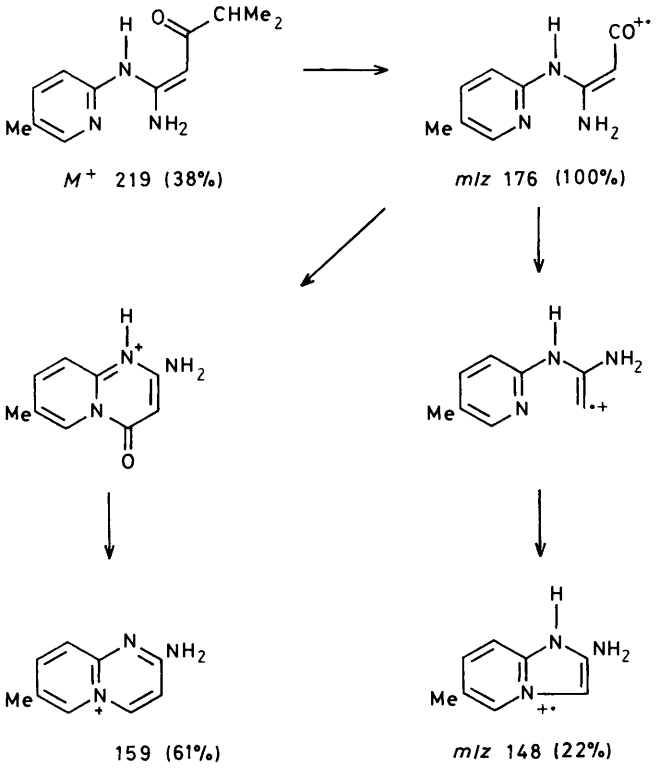


Scheme 2.

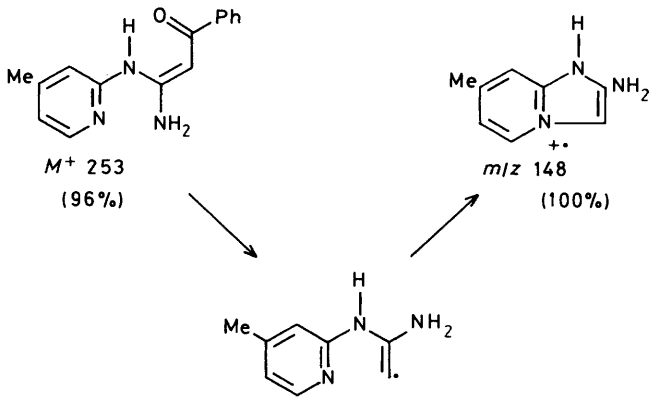
allenic nitrile) or $C_8H_8N_3OX(C_6H_5)$ from phenylpropyne-nitrile; a band in the infrared at 1 650—1 660 for a chelated, conjugated carbonyl group; a mass spectral fission pattern

† Ring–chain tautomerism, followed by loss of •OH radical, always gives a very intense peak of a stable fragment; this mechanism is confirmed by a strong metastable peak at *m/z* 129.8 for entries 1—4 and at *m/z* 143.6 for entries 5—10.

which is standard for a ketone with loss of an alkyl group (usually giving the base peak) but followed by the unusual loss of OH from the ring-closed fragment,† (*e.g.* Scheme 3).



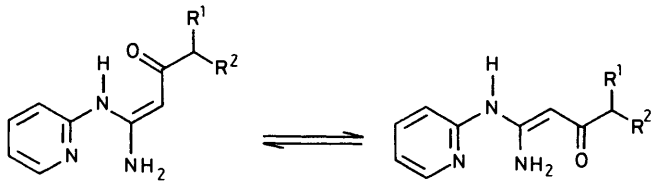
Scheme 3.



Scheme 4.

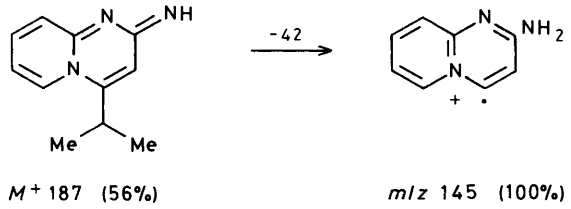
Phenyl 1-substituted ketones derived from phenylpropynenitrile lose $PhC{\equiv}O^+$ instead of the phenyl group, (Scheme 4).

^{1}H N.m.r. spectra of the ketones (**5**) in deuteriochloroform show a characteristic chelated NH proton far downfield near δ 14, assigned to the 2-amino group which participates in a strong hydrogen bond with the oxygen of the carbonyl (NH · · · O=C) in a six-membered, planar chelate (**5**). A signal at δ 8—8.1 is typical for a proton on the 6-position of a substituted 2-aminopyridine. The ^{13}C n.m.r. always shows a signal far downfield near 198 p.p.m. assigned to the carbon of a ketonic carbonyl. The pyridyl ketones (**5**) can exist in *E* and *Z* forms, and the crude product probably consists of an equilibrium mixture of these readily interconvertible enaminic ketones from which the *Z*-form appears to crystallise preferentially.

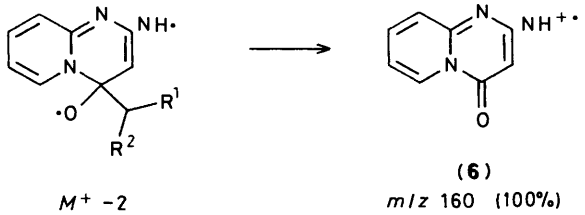


Crystalline pyridyl ketones (**5**) decompose, even when stored *in vacuo*, and after a few days the crystals are coated with a thin film which makes them unsuitable for *X*-ray diffraction. Ring-chain tautomerism (**4**) ⇌ (**5**) or *E* ⇌ *Z* isomerisation may be responsible for this phenomenon.

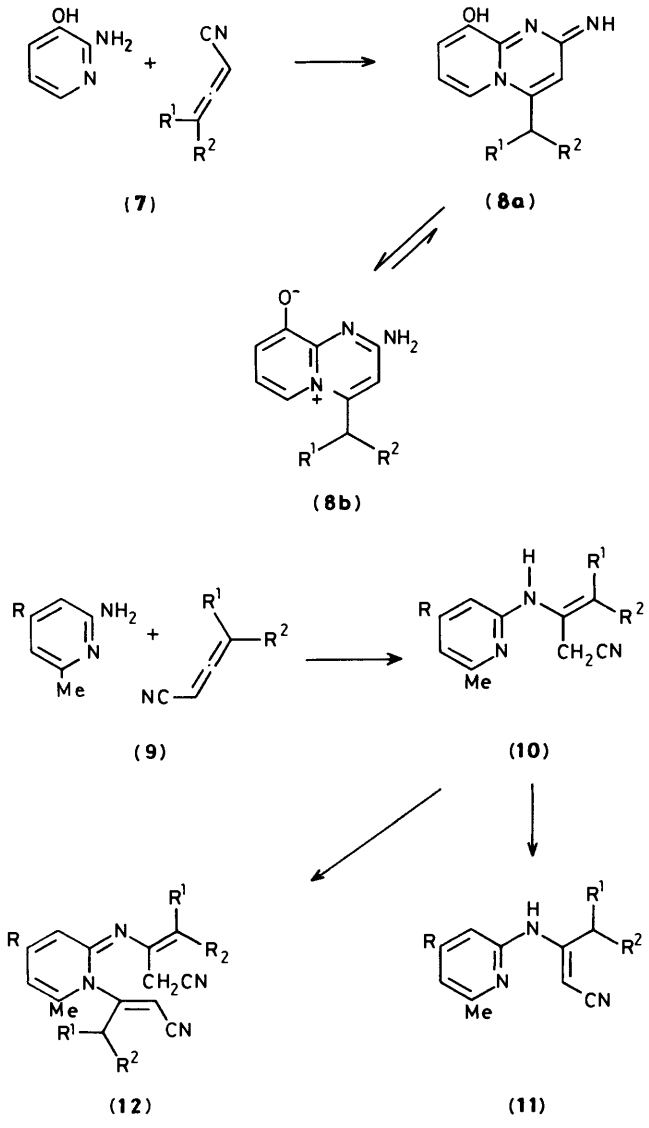
2-Aminopyridine hydrochlorides* condense with allenic nitriles, either neat at 90 °C for 20 h or in dichloromethane under reflux for 15 h, to give *ca.* 50% of the crystalline 2-iminopyrido[1,2-*a*]pyrimidine hydrochlorides as hydrates. Neither the hydrochloric acid nor the water are shown in the mass of the molecular ion in the mass spectra and neither are there signals at δ 14 in the ^{1}H n.m.r. nor at δ 198 in the ^{13}C n.m.r. spectra which proves conclusively that these are *not* hydrolysis products such as the pyridyl ketones (**5**). However, despite vigorous drying of the product *in vacuo* we were unable to obtain anhydrous material. The base peak always resulted from the loss of an alkyl group and transfer of hydrogen to the NH group to leave the stable pyrido[1,2-*a*]pyrimidine ring system:



Treatment of the hydrochloride with sodium carbonate did not yield the free base but water added spontaneously to the pyrimidine ring (which is more susceptible to nucleophilic attack than the pyridine ring) in the 4-position to give 4-alkyl-2-amino-4-hydroxypyrido-4*H*-[1,2-*a*]pyrimidines as hydrates (**4**). The water cannot be removed without causing fission of the pyrimidine ring. These compounds do not give a molecular ion, M^+, but $M^+ - 1$ and particularly $M^+ - 2$ are well defined. The latter loses the alkyl side chain to give 2-amino-4*H*-pyrido[1,2-*a*]pyrimid-4-one (**6**), usually as the base peak:



* 2-Aminopyridine hydrochlorides were prepared by passing HCl gas into an ethereal solution of the aminopyridines (5 g) for 10 min. The oily products were used as soon as possible.



Prolonged reflux of the pyridopyrimidine hydrochloride in 95% ethanol with sodium carbonate gave the pyridyl ketone (**5**) previously obtained directly from the allenic nitrile and 2-aminopyridine under similar conditions.

Phenylpropynenitrile, an example of an acetylenic nitrile, reacts similarly with 2-aminopyridines to give 2-imino-4-phenyl-pyrido[1,2-*a*]pyrimidines which are hydrolysed with great ease to ketones [Table: compounds (**14**)—(**18**)].

9-Hydroxy-2*H*-pyrido[1,2-*a*]pyrimidines, prepared from 2-amino-3-hydroxypyridine (**7**) and allenic nitriles are the only free bases which do not hydrolyse spontaneously. Here, internal salt formation (**8b**) provides the necessary stabilisation.

Under similar conditions, 2-amino-6-methylpyridine (**9**; R = H) and 2-amino-4,6-dimethylpyridine (**9**; R = Me) did not give pyridopyrimidines or hydrolysis products but a mixture of mono- and bis-adducts tentatively formulated as (**10**), (**11**), and (**12**), possibly by initial attack of the 2-amino group on the central carbon of the allene due to steric retardation at the ring nitrogen. 2-Amino-3-nitro-, 2,6-diamino-, and 2-amino-3,5-dibromopyridines either do not react with allenic nitriles and phenylpropynenitrile, even after reflux for 120 h, or the product is completely hydrolysed regenerating the starting pyridine.

Experimental

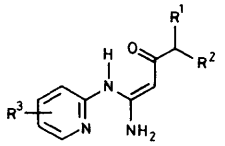
I.r. spectra were determined on a Perkin-Elmer 257 and 337 spectrometer, u.v. spectra for ethanolic solutions on Perkin-Elmer 137, Beckman 25 and Carey spectrometers, and n.m.r. spectra on Perkin-Elmer R12B, JEOL 60 and Bruker 250 spectrometers in deuteriochloroform unless otherwise stated. Allenic and acetylenic nitriles were prepared as previously reported.[8]

1-*Amino*-4-*methyl*-1-*pyridin*-2-*ylaminohex*-1-*en*-3-*one*.—4-Methylhexa-2,3-dienenitrile (1.14 g, 10.7 mmol) and 2-aminopyridine (0.94 g, 10 mmol, recrystallised from ethanol) were dissolved in ethanol (95%; 220 ml) and heated under reflux for 72 h. Evaporation of the ethanol gave a brown oil (2.51 g) which solidified when allowed to stand at room temperature. Column chromatography of the solid (neutral alumina, 200 g, activity 4), with gradient elution with ether–hexane gave a product (1.97 g, 90%) which recrystallised to give the title compound (1.4 g, 64%) as yellow flaky crystals, m.p. 127—129 °C (entry 2, Table), $\nu_{max.}$(KBr) 3 300 (NH), 3 250 and 3 150 (NH_2), 1 660 (C=O), 1 620—1 600 (C=N, C=C), and 1 520 cm^{-1} (NH deform.); $\lambda_{max.}$(EtOH) 240 (7 800), 250 (8 000), and 320 nm (38 000); δ_H($CDCl_3$) 0.898 (3 H, t, *Me*CH_2 *J* 7.3 Hz), 1.098 (3 H, d, *Me*CH, *J* 6.7), 1.380 (1 H, quintet, C*H*HMe, diastereotopic, *J* 6.8 Hz), 1.661 (1 H, quintet, CH*H*Me diastereotopic, *J* 7 Hz), 2.147 (1 H, sextet, CH_2CHMe), 4.752 (1 H, s, C≡CH), 6.854 (2 H, d and dd, pyridine 3- and 5-H), 7.564 (1 H, t, pyridine 4-H), 7—8 (2 H, br, NH_2), 8.145 (1 H, d, pyridine 6-H), and 13.99 (1 H, br s, NH • • • OC); δ_C 198 (C=O), 160 (N–C=NH), 154.5 [NHC(NH_2)=C] 146 (pyridine C-6), 138 (pyridine C-4), 117 (pyridine C-3), 114 (pyridine C-5), 81 (*CH*=C), 47 (*C*HMe), 27 (*C*H_2Me), 18 (*Me*CH), and 12 (CH_3CH_2); *m/z* 219 (M^+, 23%), 162 (100), 145 (73), 129.8 (metastable, 162 − OH = 145), and 94 (75). Entries 1 and 3—18 of the Table were prepared similarly and have ^{1}H and ^{13}C n.m.r. and mass spectra in complete accord with their different sidechains.

2-*Imino*-4-(1-*methylpropyl*)-2*H*-*pyrido*[1,2-a]*pyrimidine Hydrochloride*.—4-Methylhexa-2,3-dienenitrile (0.47 g, 4.4 mmol) and 2-aminopyridine hydrochloride (0.49 g, 3.8 mmol) in dichloromethane (20 ml) were refluxed for 14.5 h, after which time the solvent was evaporated and the residue was dried at 1 mmHg and 50 °C to give a crude product (0.91 g, 95%). Crystallisation and recrystallisation of the crude product from chloroform gave 2-imino-4-(1-methylpropyl)-2*H*-pyrido[1,2-*a*] pyrimidine hydrochloride monohydrate (0.38 g, 41%), m.p. 75—77 °C (Found: C, 55.8; H, 7.06; N, 16.5; Cl, 13.6. $C_{12}H_{15}N_3$·HCl·H_2O requires C, 56.4; H, 7.05; N, 16.4; Cl, 13.6%); $\nu_{max.}$(KBr) 2 800—3 600 (broad bands OH, $\overset{+}{N}H_2$), 1 640, 1 620, and 1 570 cm^{-1} (C=N, C=C, NH deform.); $\lambda_{max.}$ 232 (32 000), 282 (11 800), 290 (11 900), and 310—355sh nm (3 400—2 800); δ_H(CD_3OD–$CDCl_3$) 1.05 (3 H, t, *Me*CH_2), 1.40 (3 H, d, *Me*CH), 1.40—1.94 (2 H, two overlapping sextets, CH_2Me), 3.54—3.61 (1 H, sextet MeC*H*CH_2), 7.49 (1 H, s, C=C*H*), 7.49 (1 H, t, 7-H), 7.65 (1 H, d, 9-H), 8.12 (1 H, d, H^8), 8.77 (1 H, v br s, OH, exchanges with D_2O), 8.94 (1 H, d, 6-H), and 9.25 (1 H, br s, NH (exchanges D_2O); δ_C 11.0 (*Me*CH_2), 17.1 (*Me*CH), 27.1 (CH_2), 34.4 (CH), 106.3 (C-7), 117.2 (C-3), 125.1 (C-9), 130.4 (C-8), 151.4 (C-4), 156.3 (C-2), and 160.6 (C-9a); *m/z* 201 (M^+, 60%), 187 (42), 173 (36), and 145 (100).

2-*Imino*-4-(1-*isopropyl*)-2H-*pyrido*[1,2-a]*pyrimidine Hydrochloride*.—Similarly 4-methylpenta-2,3-dienenitrile (0.51 g, 4.8 mmol) and 2-aminopyridine hydrochloride (0.568 g, 4.4 mmol) in dichloromethane (20 ml) for 14.5 h gave a crude product (0.8 g, 81%) which, after recrystallisation, gave the title compound as a dihydrate (0.37 g, 45%), m.p. 245—246 °C (Found: C, 50.87;

Table.



Entry	R^3	R^2	R^1	t (h)	Yield	M.p.	Found C	Found N	Found N	Required C	Required H	Required N	M^+
1	H	Me	Et	72	75	Oil	64.2	7.4	20.0	64.4	7.3	20.5	205
2	H	Me	Et	72	64	127	65.6	6.8	19.6	65.8	7.8	19.2	219
3	H	Et	Et	72	75	162	66.8	8.1	17.8	67.0	8.1	18.0	233
4	H	Me	Pr	72	72	156	66.8	8.1	17.9	67.0	8.1	18.6	233
5	3-Me	Me	Me	72	72	148	65.5	7.9	19.4	65.8	7.8	19.2	219
6	3-Me	Me	Et	120	75	104	67.2	8.8	18.5	67.0	8.1	18.0	233
7	4-Me	Me	Et	72	43	148	66.8	8.2	18.6	67.0	8.1	18.0	233
8	4-Me	Et	Et	154	76	163	67.7	8.8	16.6	68.0	8.5	17.0	247
9	5-Me	Me	Me	131	79	148	65.8	7.8	19.0	65.8	7.8	19.2	219
10	5-Me	Me	Et	70	80	180	65.8	7.8	19.2	65.8	7.8	19.2	233
11	3-NH_2	Me	Et	72	73	120	61.6	7.6	23.9	61.5	7.7	23.9	234
12	3-NH_2	Et	Et	72	79	139	62.6	8.0	22.2	62.9	8.1	22.6	248
13	3-NH_2	Me	Pr	72	77	126	62.8	8.2	22.4	62.9	8.1	22.6	248
14	H	Ph*		76	70	178	69.9	5.4	16.9	70.3	5.4	17.6	239
15	3-Me	Ph*		70	65	179	71.1	5.4	16.5	71.1	5.9	16.5	253
16	4-Me	Ph*		122	69	154	71.1	5.5	16.4	71.1	5.9	16.5	253
17	5-Me	Ph*		75	74	213	71.1	6.0	16.6	71.1	5.9	16.5	253
18	3-NH_2	Ph*		72	73	190	66.0	5.6	22.0	66.1	5.5	22.0	254

* R^1R^2CH = Ph

H, 7.10; N, 16.2. $C_{11}H_{13}N_3$·HCl·$2H_2O$ requires C, 50.87; H, 6.94; N, 16.18%); $\nu_{max.}$(KBr) 3 600—2 850 (NH_2, OH), 1 640, 1 629, and 1 570 cm^{-1} (C=N, C=C, NH deform.); $\lambda_{max.}$ 230 (25 000), 280 (10 600), 290 (10 800), and 310—335sh nm (3 100—2 800); δ_H($CDCl_3$–CD_3OD) 1.42 (6 H, d, *Me*CH), 3.50 (4 H, br s, $2H_2O$), 3.76 (1 H, septet, Me_2CH), 7.49 (2 H, s, 3-H and 7-H), 7.64 (1 H, d, 9-H), 8.14 (1 H, t, 8-H), 8.73 (1 H, s, NH exchanges D_2O), 8.95 (1 H, d, 6-H), and 9.22 (1 H, s, NH, exchanges D_2O); δ_C 20.4 (Me_2CH), 28.2 (Me_2CH), 105.6 (C-3), 117.2 (C-7), 125 (C-8), 131 (C-9), 139.5 (C-6), 151.3 (C-4), 157.2 (C-9a), and 160.7 (C-2); *m/z* 187 (M^+, 56%), 145 (100, metastable 112.4), and 78 (36).

2-*Imino*-9-*methyl*-4-(1-*methylpropyl*)-2H-*pyrido*[1,2-a]*pyrimidine Hydrochloride*.—4-Methylhexa-2,3-dienenitrile (0.51 g, 5.3 mmol) and 2-amino-3-methylpyridine hydrochloride (0.88 g, 6.1 mmol) were heated with stirring at 90 °C for 19.5 h to give a crude product (1.2 g, 88.6%). Dry column flash chromatography and recrystallisation of this from chloroform gave 2-imino-9-methyl-4-(1-methylproply)-2*H*-pyrido[1,2-*a*]pyrimidine hydrochloride hydrate (0.67 g, 50%) (Found: C, 56.2; H, 7.3; N, 15.4. $C_{13}H_{17}N_3$·HCl·$1.5H_2O$ requires C, 56.0; H, 7.5; N, 15.1%); $\nu_{max.}$(KBr) 3 500—2 700 (multiple peaks NH, OH), 1 640, 1 615, and 1 565 cm^{-1} (C=N, C=C, NH deform.); $\lambda_{max.}$ 234 (16 000), 286sh (6 800), 295 (7 300), and 334 and 348sh nm (1 200—1 000); δ_H(CD_3OD–$CDCl_3$) 1.084 (3 H, t, $MeCH_2$), 1.460 (3 H, d, *Me*CH), 1.758 (1 H, ddq, diastereotopic CH_2), 1.945 (1 H, ddq, diastereotopic CH_2), 2.60 (3 H, s, MeC), 3.525 (1 H, sextet, CH_2CHMe), 7.151 (1 H, s, 3-H), 7.394 (1 H, t, $J_{7,8} = J_{7,6} = 7.1$ Hz, 7-H), 8.00 (1 H, d, $J = 7.1$ Hz, 8-H), and 8.683 (1 H, d, 6-H); δ_C 11.5 (Me), 18.57 (Me), 18.62 (Me), 28.6 (CH_2), 36.4 (CH), 106.5 (C-3), 118 (C-7), 129 (C-6), 136 (C-9), 139 (C-8), 153 (C-4), 159 (C-9a), 162 (C=N-2); *m/z* 215 (M^+, 62%), 200 (37), 187 (36), 173 (23), and 159 (100).

2-*Imino*-4-*isopropyl*-9-*methyl*-2H-*pyrido*[1,2-a]*pyrimidine Hydrochloride*.—4-Methylpenta-2,3-dienenitrile (0.56 g, 6 mmol) and 2-amino-3-methylpyridine hydrochloride (0.86 g, 5.9 mmol) at 90 °C for 24 h similarly gave 2-imino-4-isopropyl-9-methyl-2*H*-pyrido[1,2-*a*]pyrimidine hydrochloride monohydrate (0.7 g, 49%), m.p. 139—141 °C (Found: C, 55.84; H, 7.17; N, 16.54; Cl, 13.75. $C_{12}H_{15}N_3$·HCl·H_2O requires C, 56.36; H, 7.05; N, 16.44; Cl, 13.89%); $\nu_{max.}$(KBr) 3 500—2 700 (OH and NH), 1 650, 1 620, and 1 575 cm^{-1} (C=N, C=C, NH deform.); $\lambda_{max.}$ 232 (23 000) and 238sh (22 500), 286 (9 500), 294 (9 900) 334sh (3 300), and 340sh nm (2 800); δ_H[$CDCl_3$–$(CD_3)_2SO$], 1.42 (6 H, d, Me_2CH), 2.55 (3 H, s, *Me*C), 3.39 (2 H, s, H_2O exchanges with D_2O), 3.735 (1 H, septet, Me_2CH), 7.394 (1 H, t, *J* 6.5 Hz, 7-H), 7.48 (1 H, s, 3-H), 7.984 (1 H, d, *J* 6 Hz, 8-H), 8.655 (1 H, s, NH, exchanges with D_2O), 8.783 (1 H, d, *J* 6.5, 6-H), and 9.195 (1 H, s, NH, exchanges with D_2O); δ_C 18.2 (*Me*C), 20.6 (Me_2), 28.4 (Me_2CH), 105.3 (C-3), 116.4 (C-7), 128.7 (C-6), 133.4 (C-9), 137.9 (C-8), 150.8 (C-4), 157.5 (C-10), and 160.1 (C-2); *m/z* (20 eV) 201 (M^+, 65), 186 (26), 173 (15), 159 (53), 84 (81), and 66 (100); metastable peaks at *m/z* 172.1 and 148.9.

9-*Hydroxy*-2-*imino*-4-(1-*methylpropyl*)-2H-*pyrido*[1,2-a]*pyrimidine*.—4-Methylhexa-2,3-dienenitrile (1.1 g, 10 mmol) in ethanol (95%; 100 ml) and 2-amino-3-hydroxypyridine (1.11 g, 10 mmol) in ethanol (95%, 100 ml) were refluxed for 72 h to give the title compound (2.1 g, 91%) which recrystallised from aqueous Me_2SO (1.9 g, 87.5%), m.p. 142 °C (Found: C, 66.4; H, 6.5; N, 19.5. $C_{12}H_{15}N_3O$ requires C, 66.3; H, 6.9; N, 19.4%); $\nu_{max.}$ 3 310 (OH), 3 160 (NH), 1 650, 1 590, and 1 540 (C=N, C=C, NH deform.); $\lambda_{max.}$ 204 (15 400), 246 (13 400), and 370 nm (7 200); δ_H 1.03 (3 H, t, (CH_3CH_2), 1.4 (3 H, d, CH_3CH), 1.53 (2 H, quintet, CH_3CH_2CH), 2.17 (1 H, sextet, $MeCHCH_2$), 4.67 (2 H, br s, NH, OH exchanges with D_2O), 6.9 (1 H, s, H^3), 7.17—7.4 (2 H, m, 7-, 8-H), and 7.43 (1 H, d, 6-H).

4-(1-*Ethylpropyl*)-9-*hydroxy*-2-*imino*-2H-*pyrido*[1,2-a]*pyrimidine*.—4-Ethylhexa-2,3-dienenitrile (1.21 g, 10 mmol) in ethanol (100 ml) and 3-amino-3-hydroxypyridine (1.1 g, 10 mmol) in ethanol (95%; 100 ml) were heated under reflux for 72 h to give the title compound which recrystallised from Me_2SO–water, m.p. 155 °C, $\nu_{max.}$(KBr) 3 500—2 400 (OH, NH) 1 660, 1 600, and 1 560 (C=N, C=C, NH deform.); $\lambda_{max.}$ 204 (15 200),

246 (13 00), and 370 nm (7 000); $\delta_H(CD_3OD–CDCl_3)$ 0.84 [6 H, t, $(CH_3CH_2)_2$], 1.65 [4 H, quintet $(MeCH_2)_2CH$], 3.05 (1 H, quintet, $CHEt_2$), 5.0 (s, NH_2, OH), 6.94 (1 H, s, 3-H), 7.10—7.35 (2 H, m, 7-, 8-H), and 7.40 (1 H, d, 6-H).

2-Amino-4-hydroxy-4-(1-methylpropyl)-4H-pyrido[1,2-a]pyrimidine.—2-Imino-4-(1-methylpropyl)pyrido[1,2-*a*]pyrimidine hydrochloride (0.5 g, 2 mmol) in ethanol (95%; 100 ml) and sodium carbonate (0.5 g) were stirred for 10 h at room temperature. Filtration, evaporation, and extraction of the crude product with chloroform gave the title compound (0.35 g, 80%) as a hydrate, $\delta_H[(CD_3)_2SO–CDCl_3]$ 1.046 (3 H, t, $MeCH_2$), 1.403 (3 H, d, *Me*CH), 1.699 (1 H, sextet, $MeCH_2CH$, diastereotopic) 1.871 (1 H, sextet, $MeCH_2CH$, diastereotopic), 3.538 (3 H, s, H_2O), 3.584 (1 H, sextet, $MeCHCH_2$), 7.495 (1 H, s, 3-H), 7.495 (1 H, t, 7-H), 7.648 (1 H, d, 9-H), 8.128 (1 H, t, 8-H), 8.178 (1 H, s, NH), 8.768 (1 H, s, NH), 8.944 (1 H, d, 6-H), and 9.254 (1 H, s, NH); δ_C 11.02 (Me), 17.92 (Me), 27.14 (CH_2), 34.35 (CH), 106.26 (C-3), 117.22 (C-7), 125.07 (C-9), 130.78 (C-8), 139.37 (C-6), 151.43 (C-4), 156.28 (C-2), and 160.63 (C-9a); *m/z* 218 ($M^+ - 1$, 19%), 217 ($M^+ - 2$, 100), and 160 (217 − C_4H_9, 42).

2-Amino-4-hydroxy-4-isopropyl-4H-pyrido[1,2-a]pyrimidine.—2-Imino-4-isopropylpyrido[1,2-*a*]pyrimidine hydrochloride (0.46 g, 2 mmol) was stirred vigorously with sodium carbonate (0.21 g, 2 mmol) for 10 h in ethanol (95%; 100 ml). Removal of the inorganic material by filtration and evaporation of the solvent gave 2-amino-4-hydroxy-4-isopropyl-4*H*-pyrido[1,2-*a*]pyrimidine hydrate (0.3 g), $\delta_H[(CD_3)_2SO–CDCl_3]$, 1.407 (6 H, d, Me_2CH), 3.526 (5 H, s, OH), 3.741 (1 H, septet, $CHMe_2$), 7.422 (1 H, s, 3-H), 7.422 (1 H, t, 7-H), 7.482 (1 H, d, 9-H), 8.138 (1 H, t, 8-H), 8.779 (1 H, s, NH), 8.937 (1 H, d, 6-H), and 9.168 (1 H, s, NH); δ_C 20.4 (Me), 28.13 (CH), 105.45 (C-3), 117.1 (C-7), 124.93 (C-9), 130.98 (C-8), 139.5 (C-6), 151.33 (C-4), 157.2 (C-2), and 166.68 (C-9a); *m/z* 204 ($M^+ - 1$, 4.5%), 203 ($M^+ - 2$, 30), and 160 (203 − C_3H_7, 100).

Hydrolysis of 2-Imino-4-alkyl-2H-pyrido[1,2-a]pyrimidine Hydrochlorides.—2-Imino-4-isopropyl-2*H*-pyrido[1,2-*a*]pyrimidine hydrochloride (0.23 g, 1 mmol) in ethanol (95%; 10 ml) and sodium carbonate (0.15 g, 14 mmol) were heated under reflux for 24 h to give, after removal of the inorganic material by filtration and evaporation of the solvent, 1-amino-4-methyl-1-pyridin-2-ylaminopent-1-en-3-one (entry 1, Table) (0.20 g, 98%).

Entries 2, 5, and 6 (Table) were prepared similarly and had identical analysis and spectra to those previously prepared from 2-aminopyridines and allenic nitriles.

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