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STUDIES OF THE ELIMINATION OF 4-ARYL-3-METHYL-4-PIPERIDINOLS—II[1]

$\pi \rightarrow \pi^*$ TRANSITIONS IN SOME 4-ARYL-1,2,5,6-TETRAHYDROPYRIDINES

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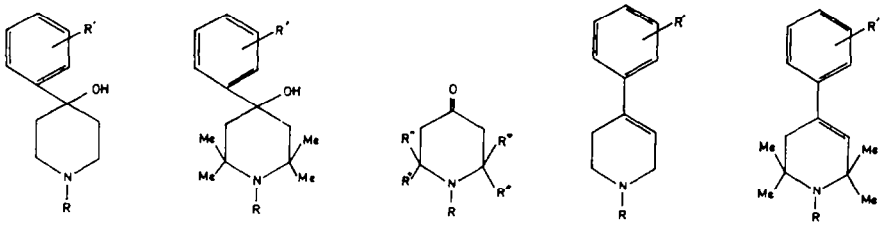
Abstract—The electronic absorption characteristics of some 4-phenyl-, *p*-tolyl-, *p*-methoxyphenyl- and *p*-dimethylaminophenyl-1,2,5,6-tetrahydropyridines are shown to differ from those of corresponding hydrochloride and quaternary salts. These differences are interpreted in terms of the influence of electronic factors upon the $\pi \rightarrow \pi^*$ transitions of the styrenoid chromophore present in these bases. In the case of the *p*-dimethylaminophenyl derivatives, this interpretation is supported by pK_a' data.

OUR work on the elimination of 4-arylpiperidinols[1] has made available a wide range of 1,4-di-, 1,3,4-tri- and 1,4,5-tri-substituted 1,2,5,6-tetrahydropyridines. In this paper the electronic absorption spectra of some 1,4-disubstituted bases together with those of corresponding hydrochloride and quaternary salts are reported. Certain spectral differences observed are interpreted in terms of the influence of electronic factors upon $\pi \rightarrow \pi^*$ transitions of the styrenoid chromophore present in these bases.



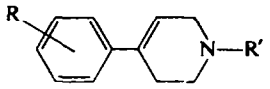
(I) (II) (III) (IV) (V)

R = (a) Me, (b) Et, (c) CH_2Ph, (d) $(CH_3)_2Ph$, (e) H, (f) NMe_2

Experimental procedures and spectral data. 4-Aryl-4-piperidinols (I and II), obtained by treating the 4-piperidones (III) with lithium aryls or Grignard reagents, were dehydrated by treatment with a mixture of acetic and hydrochloric acids at the reflux temperature or ethanolic hydrogen chloride at room temperature. The latter process was successful in the case of the 4-*p*-dimethylaminophenylpiperidinols, a result which demonstrates the ability of a *p*-dimethylamino group to facilitate the dehydration of 4-phenylpiperidinols.[2] A number of reference compounds such as 1-(*p*-dimethylaminophenyl)cyclohex-1-ene (derived from cyclohexanone and lithium *p*-dimethylaminophenyl) were also prepared. The electronic absorption characteristics of the tetrahydropyridine (IV and V) hydrochlorides (recorded in ethanol before and after the addition of ammonia or sodium hydroxide) are given in Tables 1 and 2.

[1] Part I, A. F. Casy, A. H. Beckett, M. A. Iorio and H. Z. Youssef, *Tetrahedron* **21**, 3387 (1965).
[2] A. F. Casy, A. H. Beckett and N. A. Armstrong, *Tetrahedron* **16**, 85 (1961).

TABLE 1. UV ABSORPTION CHARACTERISTICS OF SOME 4-ARYL-1,2,5,6-TETRAHYDROPYRIDINES IN ETHANOL



Compound	R	R′	λ_{max} mμ (log ε)		Δλ mμ[a]
			Base	Hydrochloride	
1[b]	H	H	247·5(4·09)	246(4·09)	−1·5
2[c]	H	Me	247(4·10)	245(4·10)	−2
3	H	Et	247·5(4·09)	244·5(4·09)	−3
4[d]	H	CH_2Ph	247(4·15)	245(4·15)	−2
5	H	$(CH_2)_2Ph$	248(4·13)	246(4·13)	−2
6	*p*-Me	CH_2Ph	251(4·22)	251(4·21)	0
7	*p*-OMe	CH_2Ph	257·5(4·25)	259(4·24)	+1·5
8[d]	*p*-OMe	$(CH_2)_2Ph$	256(4·26)	258·5(4·25)	+2·5
9 (V, R = Me, R′ = H)	—	—	246(4·22)	243(4·10)	−3

[a] $\Delta\lambda = \lambda_{max}$ HCl − λ_{max} Base; +ive value represents a *red* shift, −ive value, a *blue* shift upon protonation of the base.

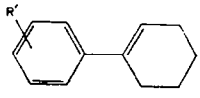
[b] Ref. 3.

[c] Ref. 4.

[d] Ref. 2.

DISCUSSION

The absorption maxima of the five 4-phenyl derivatives (Table 1, Compounds 1–5) as free bases, fall in the range 247–248 mμ with an extinction coefficient near 12,500 in most cases. Thus the chromophore present in the 4-phenyltetrahydropyridines appears to resemble very closely that of styrene (λ_{max} 244–248 mμ, ε 7940–14,450).[5]



(VI)

Since 4-phenylcyclohexene (VI, R = H) has similar absorption characteristics (λ_{max} 247 mμ, ε 12,300 in EtOH),[6] replacement of a ring methylene by nitrogen has little influence upon $\pi \rightarrow \pi^*$ transitions in this compound. When the bases (Table 1, compounds 1–5) are protonated, their absorption maxima show small but consistent blue shifts of 1·5–3 mμ with no significant change in intensity. A similar example is provided by the tetramethyl derivative (V, R = Me, R′ = H). When the bases (Table 1, compounds 2–4) are quaternized with methyl iodide, their absorption maxima move even further towards shorter wave lengths (λ_{max} 241–243 mμ near a

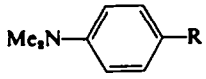
[3] C. J. Schmidle and R. C. Mansfield, *J. Amer. Chem. Soc.* **78**, 1702 (1956).

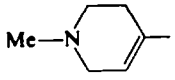
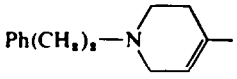
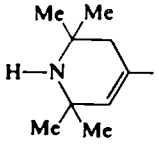
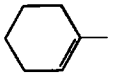
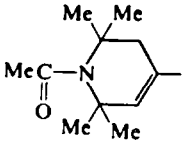
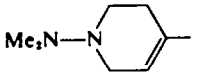
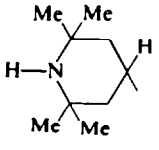
[4] C. J. Schmidle and R. C. Mansfield, *J. Amer. Chem. Soc.* **77**, 5698 (1955).

[5] Refs cited in *Organic Electronic Spectral Data* (Edited by M. J. Kamlet, Vol. I; H. E. Ungnade, Vol. II; J. P. Philips and F. C. Nachod, Vol. IV) Vols I, II and IV. Interscience, New York (1960 and 1963).

[6] E. W. Garbisch, Jr., *J. Org. Chem.* **27**, 4243 (1962).

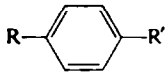
TABLE 2. UV ABSORPTION CHARACTERISTICS OF SOME 4-*p*-DIMETHYLAMINOPHENYL-1,2,5,6-TETRAHYDROPYRIDINES AND RELATED COMPOUNDS

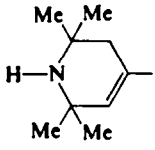
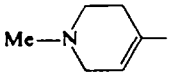
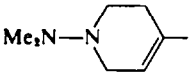
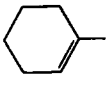
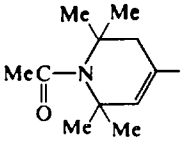
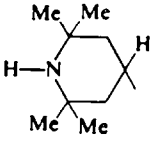


Compound	R	λ_{max} mμ (log ε)			Δλ mμ[b]
		Base in ethanol	Hydrochloride[a] in ethanol	in 0·1N HCl	
1		286·5(4·25)	297·5(4·28)	246(4·11)	+11
2[c]		286·5(4·33)	297(4·32)	245(4·18)	+10·5
3		286(4·31)	296·5(4·33)	246·5(4·20)	+10·5
4		283(4·31)	283(4·38)	254(4·16)[d]	—
5		292(4·36)	291·5(4·22)[e]	254(4·25)	—
6		287(4·3)	294(4·31)	248·5(4·11)	+7
7		254·5(4·2)	256(4·25)	—	+1·5

[a] all dihydrochlorides except 4 and 5.
[b] $\Delta\lambda = \lambda_{max}$ HCl (in EtOH) − λ_{max} Base.
[c] Ref. 2.
[d] methiodide 253·5(4·18).
[e] spectrum measured in EtOH containing a slight excess of HCl, hence ε at 291·5 mμ is reduced because the extent of hydrolysis is lower (ε at 254 mμ is correspondingly higher).

TABLE 3. pK'_a VALUES[a] OF SOME 4-*p*-DIMETHYLAMINOPHENYL-1,2,5,6-TETRAHYDROPYRIDINES AND RELATED COMPOUNDS IN 50 PER CENT ETHANOL-WATER



Compound	R	R′	pK'_{a1} (ring N)	pK'_{a2} (Ar–NMe_2)
1		NMe_2	9·39	3·67
2	〃	H	9·16	—
3		NMe_2	8·59	3·75
4	〃	H	8·07	—
5		NMe_2	5·41	3·88
6	〃	H	5·32	—
7		NMe_2	—	4·60
8		NMe_2	—	4·25
9		NMe_2	10·2	4·6

[a] uncorrected for ionic strength

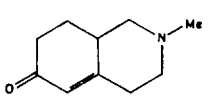
TABLE 4. 4-ARYL-1,2,5,6-TETRAHYDROPYRIDINES (IV and V)

Compound	Form	m.p.	Mol. formula	Found				Required			
				C	H	N	equiv. wt	C	H	N	equiv. wt
IVb (R′ = H)	HCl	201–202°	$C_{12}H_{16}ClN$	69·9	8·1	6·15	—	69·8	8·1	6·3	—
IVd (R′ = H)	HCl	229–230°	$C_{19}H_{22}ClN\,0{\cdot}5\,H_2O$	74·7	7·75	4·5	—	73·9	7·8	4·5	—
IVc (R′ = *p*-Me)	HCl	224–226°	$C_{19}H_{22}ClN$	75·6	7·5	4·2	—	76·1	7·4	4·7	—
IVc (R′ = *p*-OMe)	HCl	237°	$C_{19}H_{22}ClNO$	71·6	6·9	4·3	—	72·25	7·0	4·4	—
IVa (R′ = *p*-NMe_2)	di HCl	208–210°	$C_{14}H_{22}Cl_2N_2$	24·3[a]	7·7	9·75	155	24·5[a]	7·7	9·7	145
IVa (R′ = *p*-MNe_2)	base	111–112°	$C_{14}H_{20}N_2$	77·7	9·7	12·7	109	77·7	9·3	13·0	108
IVf (R′ = *p*-NMe_2)	di HCl	203–205°	$C_{15}H_{24}Cl_2N_2$	56·1	8·0	13·4	22·7[a]	56·6	7·9	13·2	22·3[a]
IVf (R′ = *p*-NMe_2)	base	95–96·5°	$C_{15}H_{22}N_2$	73·0	9·1	17·25	123	73·4	9·4	17·1	123
Ve (R′ = *p*-NMe_2)	di HCl	228–230°	$C_{17}H_{26}Cl_2N_2{\cdot}H_2O$[b]	58·1	8·9	8·1	176	58·45	8·7	8·0	175
Ve (R′ = *p*-NMe_2)	base	80·5–81°	$C_{17}H_{26}N_2$	78·9	10·4	10·8	129	79·0	10·1	10·8	129

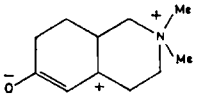
[a] Chlorine analysis [b] Cl, Found 19·4; required 20·3%

shoulder), although part of this effect is due to the interfering iodide absorption band,[7] as is demonstrated by the result with the methochloride of the base (IVc, R′ = H) which has a clear maximum at 245 mμ. These results point to some interaction between charged nitrogen and the conjugated system.

The present examples are comparable with the behaviour of 3-methyl-3-azabicyclo-[4,4,0]-dec-6-ene-8-one (VII), the absorption maximum of which suffers a small blue



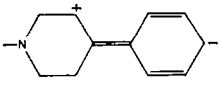
(VII)



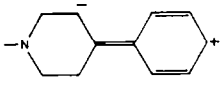
(VIII)

shift (3·5 mμ in EtOH) when the nitrogen atom is quaternized.[7] In both the tetrahydropyridines (Table 1, compounds 1–5) and the bicyclic ketone (VII) more than one sigma bond intervenes between the nitrogen atom and one end of the conjugated chromophore and, in these cases, the charged nitrogen probably exerts its effect largely by direct field action (the N to C-3 distance is approx. 2·5 Å in the tetrahydropyridines and the N to C-6 distance, 3·1 Å in the bicyclic ketone) rather than inductively. Results with the bicyclic ketone (VII) have been interpreted in terms of the positively charged nitrogen destabilizing the dipolar resonance contributor (VIII) of the excited state resulting from the $\pi \rightarrow \pi^*$ transition of the α,β-unsaturated ketonic chromophore.[7]

The absorption shifts upon protonation (or quaternization) observed with the tetrahydropyridine spectra may be explained in a similar manner, the dipolar resonance contributor (IX) being the destabilized form in the salt. The fact that protonation



(IX)



(X)

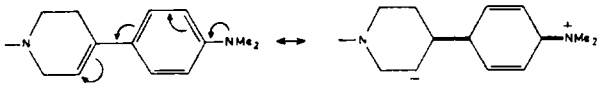
of nitrogen results in a blue, rather than a red shift of the absorption maximum of the base, indicates that in the latter the resonance contributor with a positive charge at C-3 (IX) is more significant than the one with negative charge accumulation at C-3 (X) (this would be stabilized by positively charged nitrogen) in the excited state.

The destabilizing and stabilizing influences of protonated nitrogen appear to be balanced in the *p*-tolyl base (Table 1, compound 6) since the position of its absorption maximum does not alter upon protonation; in this case a *para* methyl substituent in the aryl group would be expected to stabilize contributors of type (X); hence the contribution of type (IX) (destabilized by charged nitrogen) to the excited state should be reduced. In the *p*-methoxyphenyl derivatives (Table 1, compounds 7 and 8) there is probably a bias towards dipolar excited states with a negative charge at C-3 (X) because the absorption maxima of these compounds undergoes a small red shift (≃2 mμ) when the nitrogen atom is protonated.

This bias appears to be greater in *p*-dimethylaminophenyl derivatives, a red shift of 10–11 mμ (base to hydrochloride) being observed (Table 2, compounds 1-3),

[7] E. M. Kosower and D. C. Remy, *Tetrahedron* **5**, 281 (1959).

and could result from the contribution made by the lone-pair on nitrogen of the aryl-dimethylamino group to the resonance system (XI). Red shifts are apparent



(XI)

when the absorption maxima of the dihydrochloride salts (Table 2, compounds 1–3) are compared with those of the corresponding bases, hence the aryl-dimethylamino group of the salt must be extensively hydrolysed in ethanol.* In a solvent containing a large excess of acid (0·1N HCl—H_2O) the absorption maxima of the bases (Table 2, compounds 1–3) show extensive hyposochromic shifts (to near 246 mμ) consistent with the effective removal of the lone-pair of the now fully protonated aryl-dimethylamino group from the conjugated chromophore.

The role of charged piperidine nitrogen in stabilizing dipolar resonance contributors of the type (XI) in these 4-*p*-dimethylaminophenyltetrahydropyridines is emphasized by the fact that the UV absorption maxima of the hydrochlorides (Table 2, compounds 1–3) are significantly higher than those of the analogues (Table 2, compounds 4 and 5) which lack a basic piperidino nitrogen atom.

Evidence for an interaction between the two basic centres of the *p*-dimethylaminophenyltetrahydropyridines may also be obtained from pK_a' studies. If resonance contributors of the type (XI) are significant, the pK_a' values of the piperidine and dimethylamino nitrogen atoms should be greater and smaller respectively than those of corresponding basic centres in analogues where interaction of the type depicted in XI may not occur.

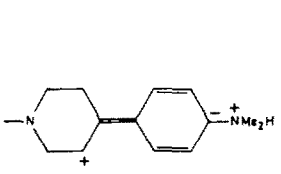
These expectations are confirmed as the results of Table 3 demonstrate. Thus in the pairs of compounds 1–2, 3–4 and 5–6 (Table 3), the pK_a' values of the ring nitrogen atoms are greater in the *p*-dimethylamino members while in the same derivatives the pK_a' value of the aryl nitrogen function is lower than those of the corresponding function in compounds 7–9 which lack either a basic atom in the ring or a conjugated double bond. The results also show that the degree to which the pK_a' of the aryl-dimethylamino group is lowered is related to the strength of the piperidine nitrogen, the stronger the latter, the weaker being the former in the series 1, 3 and 5 of Table 3.

The influence of charged nitrogen upon the chromophore of *p*-dimethylaminophenyltetrahydropyridines must be related to the basic strength of the piperidine nitrogen atom and it is significant, in this respect, that the red shift (base to salt) observed with the weakly basic hydrazine analogue (Table 2, compound 6, pK_a' of hydrazine function, 5·4) is 3–4 mμ less than that observed with the 1-methyl (Table 2, compound 1, pK_a' 8·59) and the 2,2,6,6-tetramethyltetrahydropyridine (Table 2, compound 3, pK_a' 9·16).

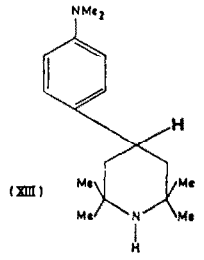
The effect of charged piperidine nitrogen upon electronic transitions in the *p*-dimethylaminotetrahydropyridines (Table 2, compounds 1–3) is also apparent when the aryl-dimethylamino group is fully protonated since the absorption maxima of the derivatives (Table 2, compounds 1–3) in N/10 HCl occur near 246 mμ [cf.

* The extensive hydrolysis of *p*-dimethylaminophenyl salts is also evident from results with the cyclohexene derivative (Table 2, comp 4).

254 mμ for *p*-dimethylaminophenylcyclohexene (Table 2·4) in the same solvent]. A protonated *p*-dimethylaminophenyl group will favour a dipolar excited state with a positive, rather than negative, charge at C-3 (XII) and this form will be destabilized



(XII)



(XIII)

by a neighbouring positive charge on the ring nitrogen atom.

Non-protonated nitrogen appears to have an influence upon electronic transitions in systems where excited states are markedly biased electronically. Thus the absorption maximum of *p*-dimethylaminophenylcyclohexene (Table 2, compound 4) suffers a red shift of 3·5 mμ when the 4-methylene group is replaced by N-methyl (a result attributable to the stabilizing influence of electronegative nitrogen upon the excited state XI) while that of bicyclo[4.4.0]dec-6-ene-8-one undergoes a blue shift of 5·5 mμ when the 3-methylene is replaced by the same function[7] (a result attributable to the destabilizing influence of nitrogen upon the excited state VIII). In contrast the 4-phenyltetrahydropyridines, which are probably not markedly biased in the above sense, have absorption maxima very close to that of phenylcyclohexene.

When the piperidine nitrogen atom is further removed from the end of the chromophore, (e.g. XIII, the saturated analogue of Ve, R′ = H), its influence upon electronic transitions is much reduced, the absorption maximum of the hydrochloride of XIII showing a red shift of only 1·5 mμ over that of the corresponding base (Table 3, compound 7).

EXPERIMENTAL*

4-Aryl-4-piperidinols (I *and* II). These were prepared from 1-methyl-4-piperidone, 2,2,6,6,-tetramethyl-4-piperidone[8] and 1-dimethylamino-4-piperidone[9] by the previously described general method.[1] In the case of IIe (R′ = NMe_2), the lithium aryl in ether was added to the piperidone rather than *vice versa*. The following new piperidinols were obtained: the 4-p-*tolylpiperidinol* (Ic, R′ = *p*-Me) *hydrochloride*, m.p. 186–187°. (Found: C, 71·7; H, 7·6; N, 4·5. $C_{19}H_{24}ClNO$ requires: C, 71·8; H, 7·6; N, 4·4%); the 4-p-*dimethylaminophenylpiperidinol* (Ia, R′ = *p*-NMe_2), m.p. 168–170°. (Found: C, 71·7; H, 9·1; N, 12·3; equiv. wt., 120. $C_{14}H_{22}N_2O$ requires: C, 71·7; H, 9·5; N, 12·0%, equiv. wt., 117); the 1-*dimethylaminopiperidinol* (If, R′ = NMe_2), m.p. 102–103°. (Found; C, 64·8; H, 9·5; N, 14·7; equiv. wt., 132. $C_{15}H_{30}N_2O{\cdot}H_2O$ requires: C, 64·1; H, 9·6; N, 14·95%; equiv. wt., 140) λ_{max} 255 mμ (log ε 4·24) in EtOH; the *tetramethylpiperidinol* (IIe, R′ = NMe_2), m.p. 96·5–97·5°. (Found: C, 74·1; H, 10·3; N, 10·1; equiv. wt., 137. $C_{17}H_{28}N_2O$ requires: C, 73·9; H, 10·2; N, 10·2%; equiv. wt., 138) λ_{max} 257 mμ (log ε 4·27) in EtOH. Reaction between lithium *p*-dimethylaminophenyl and cyclohexanone gave 1-*p-dimethylaminophenylcyclohexanol* m.p. 83–84° from pet. ether b.p. 40–60°. (Found: C, 76·5; H, 9·9; N, 6·2; equiv. wt. 216. $C_{14}H_{21}NO$ requires: C, 76·7; H, 9·65; N, 6·4%; equiv. wt., 219), λ_{max} 253 mμ (log ε 4·27).

* M.ps are uncorrected. Analyses by Drs. Weiler and Strauss, Oxford. Equiv. wts of bases and salts were determined by titration with 0·02N perchloric acid in glacial AcOH (mercuric acetate added in the case of salts) using Oracet Blue B as indicator.

[8] H. K. Hall, *J. Amer. Chem. Soc.* **79**, 5444 (1957).

[9] A. H. Beckett and J. Greenhill, *J. Med. Pharm. Chem.* **4**, 423 (1961).

4-Aryl-1,2,5,6-tetrahydropyridines (IV *and* V). The 4-*p*-dimethylaminophenyl derivatives were obtained by acidifying the appropriate piperidinol in EtOH with ethanolic HCl and diluting the product with ether when the required tetrahydropyridine separated as a dihydrochloride; in some cases the mixture was heated under reflux before being diluted with ether. All other tetrahydropyridines were obtained by the previously described general method.[1] New compounds are given in Table 4. 1-*(p-Dimethylaminophenyl) cyclohex-1-ene* (VI, R′ = NMe_2) had m.p. 54·5–55° from pet. ether b.p. 40–60°. (Found: C, 84·0; H, 9·6; N, 6·7; equiv. wt., 200. $C_{14}H_{19}N$ requires: C, 83·5; H, 9·5; N, 7·0%; equiv. wt. 201.) It gave a *hydrochloride*, m.p. 176–178° (dec) from EtOH–ether. (Found: C, 69·6; H, 8·5; N, 5·5; equiv. wt. 233. $C_{14}H_{20}ClN$ requires: C, 70·5; H, 8·4; N, 5·9%; equiv. wt. 238), and a *methiodide*, m.p. 154–156°. (Found: C, 52·6; H, 6·7; N, 3·7; equiv. wt., 345. $C_{15}H_{23}IN$ requires: C, 52·5; H, 6·5; N, 4·1%; equiv. wt., 343.)

A mixture of 2,2,6,6-tetramethyl-4-phenyl-4-piperidinol[10] (5·1 g) and aqueous formaldehyde (5 ml; 40%) was heated under reflux for 1 h, concentrated under reduced press. and the residue dissolved in HCl (7 ml) and glacial ACOH (17 ml). The product was heated under reflux for 1 hr concentrated, and the residue crystallized from EtOH–ether to give 1,2,2,6,6-*pentamethyl-4-phenyl-1,2,5,6-tetrahydropyridine hydrochloride* (4·6 g), m.p. 245° (dec.). (Found: C, 72·4; H, 9·2; N, 5·1; equiv. wt. 266. $C_{16}H_{24}ClN$ requires; C, 72·3; H, 9·1; N, 5·3%; equiv. wt. 266.)

Methiodides. Compound IVc R′ = H with MeI gave a *methiodide*, m.p. 227–228° from EtOH–water. (Found: C, 58·2; H, 6·1; N, 3·5. $C_{19}H_{22}IN$ requires: C, 58·3; H, 5·7; N, 3·6%.) The corresponding methochloride (from IVa R′ = H and benzyl chloride) had m.p. 234–235° from EtOH–ether. (Found: C, 74·4; H, 7·5; N, 5·0. $C_{19}H_{22}ClN$. 0·5 H_2O requires: C, 73·9; H, 7·8; N, 4·5%.)

The *methiodide of* IVa, (R′ = *p*-NMe_2) had m.p. 273° (dec.) from EtOH–water. (Found: C, 50·8; H, 6·3; N, 7·7; I, 35·35; equiv. wt., 185. $C_{15}H_{23}IN_2$ requires: C, 50·3; H, 6·5; N, 7·8; I, 35·4%; equiv. wt., 179), λ_{max} 293·5 mμ (log ε 4·3) in EtOH, and the *methiodide* of IVf (R′ = *p*-NMe_2) had m.p. 199·5–200·5° from water. (Found: C, 49·4; H, 6·8; N, 10·7; I, 31·2; equiv. wt. 194. $C_{16}H_{26}IN_2$ requires: C, 49·6; H, 6·8; N, 10·85; I, 32·8%; equiv. wt., 193), λ_{max} 292 mμ (log ε 4·33) in EtOH.

4-*(p-Dimethylaminophenyl)*-2,2,6,6-*tetramethylpiperidine* (XIII). A mixture of Ve (R′ = NMe_2) dihydrochloride (2 g) Adams' PtO_2 (0·3 g) and MeOH (40 ml) was shaken with H_2 at room temp and press until gas absorption ceased (calculated volume of H_2 absorbed). The mixture was filtered and the filtrate concentrated. The residue gave the *piperidine* (XIII) *dihydrochloride* (1·7 g), m.p. 228–230° (dec.) from EtOH–ether. (Found: C, 61·1; H, 9·0; N, 8·6; equiv. wt. 166. $C_{17}H_{30}Cl_2N_2$ requires: C, 61·3; H, 9·1; N, 8·4%; equiv. wt., 167.)

The derived *base* had m.p. 67·5–68°. (Found: C, 78·2; H, 10·8; N, 10·7. $C_{17}H_{28}N_2$ requires: C, 78·4; H, 10·8; N, 10·8%.)

1-*Acetyl-4-(p-dimethylaminophenyl)*-2,2,6,6-*tetramethyl*-1,2,5,6-*tetrahydropyridine.* A mixture of Ve (R′ = NMe_2; 0·9 g) and Ac_2O (5 ml) was heated under reflux for 15 min, cooled, made alkaline with NaOH aq and extracted with $CHCl_3$. The dry extract was evaporated and the residue crystallized from pet. ether b.p. 40–60° to give the 1-*acetyl derivative* (Table 3. compd. 8), m.p. 80·5–81°. (Found: C, 76·4; H, 9·4; N, 9·3; equiv. wt., 300. $C_{19}H_{28}ON_2$ requires: C, 76·0; H, 9·4; N, 9·3%; equiv. wt. 300.)

The UV absorption spectra were recorded with a Beckman D.K.2. spectrophotometer (EtOH as solvent). The pK_a' values of aryl nitrogen in the *p*-dimethylaminophenyl derivatives were determined spectrophotometrically by Beales' method.[11] Other pK_a' values were measured by Albert and Serjeants' method,[12] using 50% EtOH–water as solvent.

[10] N. J. Harper, A. H. Beckett and A. D. J. Balon, *J. Chem. Soc.* 2704 (1960).

[11] R. N. Beale, *J. Chem. Soc.* 4494 (1954).

[12] A. Albert and E. P. Serjeant, *Ionisation constants of acids and bases.* Methuen, London (1962)