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THE REARRANGEMENT OF AN N-VINYLAZIRIDINE

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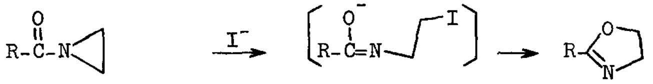
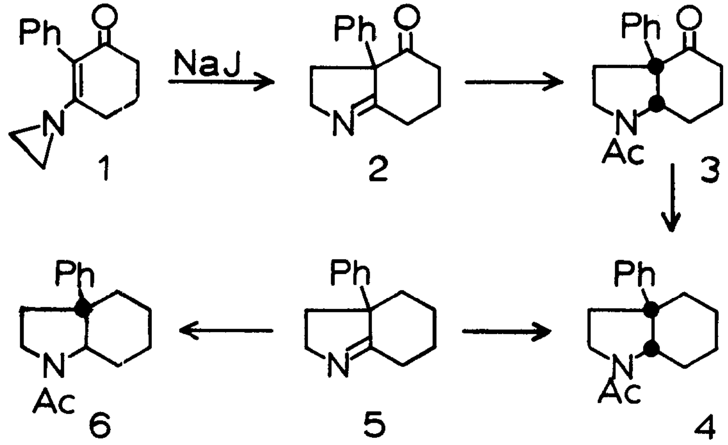
We wish to report a new and potentially useful synthesis of functionalized Δ^1-pyrrolines. The synthesis is based on the observed iodide ion catalyzed rearrangement of N-acylaziridines to oxazolines (eq. 1) (1,2).

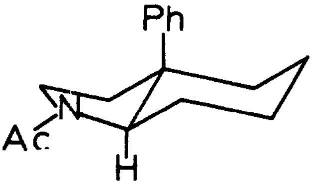


(1)

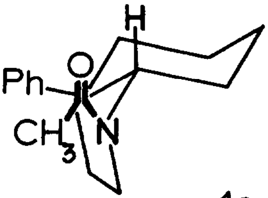
Reaction of molten 2-phenyl-3-(1'-aziridinyl)-2-cyclohexenone (3,4) (1) with sodium iodide at 110° gave in 37% yield an isomer of 1, m.p. 67-68.5°, to which we assign structure 2. The infrared spectrum of 2 suggested the presence of a six-membered ring ketone (λ_{max} 5.84 u) and an imine (λ_{max} 6.05 u), while its ultraviolet spectrum $\left[\lambda_{max}^{EtOH}\right.$ 284 mu $\left.(425)\right]$ showed loss of the conjugated system present in 1.

Catalytic hydrogenation (in ethanol-hydrochloric acid) of 2 followed by acetylation of the reduction product gave in 69% yield a single isomer (3), m.p. 104.5-106.5°, of

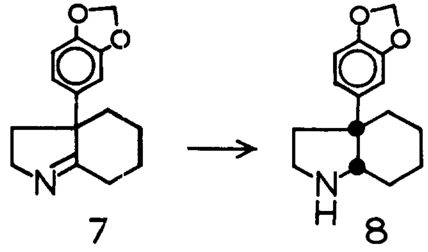




6a



4a



(Wildman)

1-acetyl-3a-phenyl-4-oxoöctahydroindole. Reaction of 3 with ethanedithiol followed by Raney nickel desulfurization of the resulting dithioketal gave 4, an oil.

Catalytic hydrogenation of 5 followed by acetylation of the reduction product also gave 4. The two independently prepared samples of 4 had identical infrared spectra, mass spectra and vapor phase chromatography retention times. Whereas catalytic hydrogenation of 5 proceeded with the exclusive production of the *cis* isomer 4, metal hydride reduction was less stereoselective; sodium borohydride and lithium aluminum hydride afforded 4 and 6 in the ratio 70:30, while lithium tri-*t*-butoxy aluminum hydride gave a 55:45 ratio. Separation and characterization of 4 and 6 was achieved by vpc.

The assignment of *cis* and *trans* ring fusions, respectively, to 4 and 6 is based on the experience of other workers in the steroid field (6) and on the observation by Wildman (7) that hydrogenation of 7 afforded only the *cis* fused product 8. The nmr spectra of 4 and 6 showed distinctive differences that were directly interpretable in terms of the assigned structures. In the spectrum of 4 the angular (C-7a) hydrogen appeared as a multiplet centered at τ 5.4 (8) and the acetyl methyl appeared as a doublet (9) at τ 7.93 and τ 8.11. The doublet collapsed to a single sharp peak on heating to 100°. These observations are consistent with conformation 4a being the major form of 4 in solution, the hydrogen at C-7a being "equatorial" (10) and

C-7 being "axial" with respect to the five-membered ring. In the spectrum of 6 the C-7a hydrogen signal had moved upfield into the methylene envelope and the acetyl methyl appeared as a single peak at τ 7.92. Structure 6a, wherein the C-7a hydrogen is perpendicular to the amide plane and the C-7 methylene group causes one of the rotational isomers of the amide to be preferred over the other, agrees with the spectrum.

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REFERENCES

1. H. W. Heine, M. E. Fetter and E. M. Nicholson, J. Am. Chem. Soc., 81, 2202 (1959).
2. H. W. Heine, W. G. Kenyon, and E. M. Johnson, ibid., 83, 2570 (1961).
3. Compound 1 was prepared from 2-phenyl-3-chloro-2-cyclohexenone by reaction with excess aziridine in ether at 25° for four days.
4. All new compounds in this work have been characterized spectrally and by satisfactory elemental analyses.
5. W. E. Bachmann and E. J. Fornefeld, J. Am. Chem. Soc., 73, 51 (1951).
6. e.g. A. F. St. Andre', H. B. MacPhillamy, J. A. Nelson, A. C. Shabica and C. R. Scholz, ibid., 74, 5506 (1952).

7. W. C. Wildman, *ibid.*, **78**, 4180 (1956).

8. The nmr spectrum of 7a-deutero-**4**, from lithium aluminum deuteride reduction of **5**, did not have this peak.

9. L. A. LaPlanche and M. T. Rogers, *J. Am. Chem. Soc.*, **86**, 337 (1964); **85**, 3731 (1963).

10. For a similar deshielding effect in esters, see L. M. Jackman and R. H. Wiley, *J. Chem. Soc.* 2886 (1960).