Tetrahedron Letters No.20, pp. 1523-1526, 1969. Pergamon Press. Printed in Great Britain.

DIAZAPOLYCYCLIC COMPOUNDS. SYNTHESIS OF SOME DIAZAHYDROPHENANTHRENES

M. F. Braña, M. Lora-Tamayo, P. Navarro and J. L. Soto

Departamento de Química Orgánica. Facultad de Ciencias.

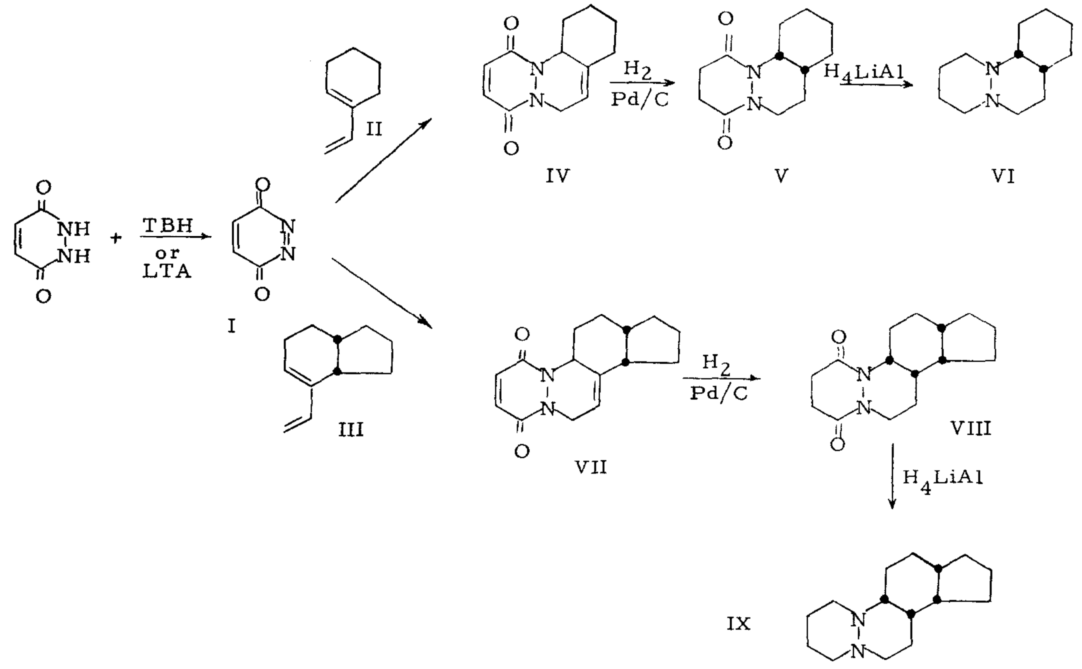
Universidad de Madrid, Spain.

(Received in UK 10 March 1969; accepted for publication 26 March 1969)

Due to the current interest in the introduction of the 1, 2-diazine grouping into the steroidal skeleton (1) we wish to report a novel synthesis of bridgehead diazasteroids. Diazaquinones have been shown (2, 3, 4) to be excellent dienophiles in Diels Alder reactions when produced by oxidation of the corresponding unsaturated hydrazides in the presence of dienes. We have employed this technique succesfully in the presence of 1-vinylcyclohexene (II) and 2, 3, 3a, 4, 5, 7a-hexahydro-7-vinylindene (III) to prepare the corresponding adducts IV and VII.

Then 38 g (0, 34 mol) of the maleic hydrazide was oxidized to the diazaquinone I with 140 g (0, 34 mol) of lead tetraacetate in the presence of 38 g (0, 34 mol) of 1-vinylcyclohexene (II) in methylene chloride as solvent at room temperature. The adduct IV was isolated by chromatographing on alumina; yield, 27 %. Recrystallisation from petroleum ether-ethyl acetate yields pale yellow crystals m. p. 119º (Calc. for $C_{12}H_{14}N_2O_2$: C, 66, 03; H, 6, 46; N, 12, 83. Found: C, 65, 93; H, 6, 51; N, 12, 59). UV (ethanol): λ_{max} = 214 and 337 mμ. IR (nujol) ν = 1600 and 1650 cm^{-1}. NMR (CCl_4): τ = 7, 4 - 9, 1; 6, 1; 5, 3; 4, 4 and 3, 2 ppm.

The adduct IV was hydrogenated over paladium or charcoal in ethanol, yielding a white solid which was recrystallized from cyclohexane, m. p. 135-6º (V). (Calc. for $C_{12}H_{18}N_2O_2$: C, 64, 83; H, 8, 16; N, 12, 60. Found: C, 64, 71; H, 7, 83; N, 13, 02. IR (nujol): 1650 cm^{-1}. NMR ($CDCl_3$): τ = 7, 7 - 8, 8; 7, 4, 7, 1 and 5, 2 ppm. The hydrogenated product was reduced with lithium aluminium hydride thus obtaining a colourless oil which rapidly became reddish on contact with air



(VI). It was distilled under nitrogen, b.p. 84º/5 mm. (Calc. for $C_{12}H_{22}N_2$: C, 74,17; H, 11,41; N, 14,41. Found: C, 74,12; H, 10,85; N, 14,88). In the IR spectrum, the bands at 1600 and 1650 cm^{-1} of the original adduct disappear. NMR (CCl_4): τ = 7,8 - 9; 6,8 - 7,8 ppm.

The following derivatives of VII were prepared: hydrochloride, recrystallized from benzene, m.p. 170,5 - 172,5º. (Calc. for $C_{12}H_{23}N_2Cl$: C, 62,45; H, 10,04; N, 12,13; Cl, 15,36. Found: C, 62,30; H, 9,60; N, 12,29; Cl, 15,50) and picrate, recristallized from ethanol, m.p. 134-5º. (Calc. for $C_{18}H_{25}N_5O_7$: C, 51,05; H, 5,95; N, 16,54. Found: C, 50,53; H, 5,41; N, 16,10).*

We have established the configuration of V on the basis of its NMR spectrum. In this compound the B/C junction is cis, as can be concluded from the following considerations. In

---

* No b.p. is reported De Waard´s product, and the m.p. of the picrate es 56-59º.

the spectrum of V there appears a wide signal at τ values between 7,7 and 8,8 ppm, assigned to the 11 cyclohexanic protons of ring B and C, not adjoining the two nitrogen atoms. The four hydrogens of ring A, adjoining the two CO groups, are represented by a singlet at τ = 7,4 ppm, which proves the rapid chair to chair interconversion of this ring, enhanced by the interchange in the type of fusion of rings A and B. It was expected that the remaining three protons, i.e. those adjoining the nitrogen atoms, would appear in the spectrum below 7,5 ppm and, in fact, in this region, besides the already mentioned signal of four hydrogens at 7,4 ppm, there appear three protons, two at values of τ = 5,2 ppm and one at 7,1 ppm. The considerable difference –almost 2 ppm– of these two signals is only justified if two of them are equatorial and located in the neighbourhood of the plane of the near-by CO group (5). On account of this, the configuration of rings B and C must necessarily be <u>cis</u>, as a <u>trans</u> union requires that two of these three hydrogens, be axial and one equatorial. Moreover, the proton with centre at 7,1 ppm takes the appearance of a triplet ($J \approx J' \approx 11$ Hz) split by an additional coupling ($J'' \approx 4$ Hz) which confirms its axial assignment, as this proton must show a geminal coupling ($\approx$ 12 Hz), an axial-axial coupling ($\approx$ 9 Hz) and a third axial-equatorial coupling (2-5 Hz).

The adduct VII was obtained by oxidizing the maleic hydrazide (1, 1 g) with <u>t</u>-butyl hypochlorite (0,66 g) in anhydrous acetone at -60º, and adding 2,3,3a,4,5,7a-hexahydro-7-vinylindene (III) (1, 1 g). An oil was obtained which on chromatographing on alumina (ethyl acetate) gave VII. An analytically pure sample was obtained by recrystallizing from ethanol, m.p. 168º. (Calc. for $C_{15}H_{18}N_2O_2$: C, 69,74; H, 7,02; N, 10,84. Found: C, 69,48; H, 7,02; N, 10,80). UV (ethanol): λ_{max} = 218 and 337 mμ. IR (nujol): ν = 1635 and 1590 cm^{-1}. NMR ($CDCl_4$): τ = 7,5 - 8,8; 7,18; 5,88; 5,1; 4,8; 4,2 and 2,98 ppm.

Hydrogenation of adduct VII, carried out over palladium on charcoal (as in the preparation of V), gave VIII as a white solid, recrystallized from cyclohexane, m.p. 153-5º. Compound VIII showed IR^{KBr} bands for CO at 1685 and 1675 cm^{-1} and the NMR is completely parallel to that found for V, showing signals at τ^{CDCl_3} = 7,8 - 8,8 ppm (15 protons, broad multiplet, of rings B, C and D not contiguous to nitrogen); 7,45 (4 protons, singlet, of ring A); 7,19 (1 proton, multiplet, in 6 axial position) and 5,26 ppm (2 protons, multiplet, in 6 and 9 equatorial position), leading us to propose again a *cis* juncture of rings B and C.

Reduction of 100 mg of VIII with lithium aluminium hydride gave IX, an oil, which rapidly decomposes on contact with the atmosphere, from which a picrate was prepared (in ethanol), m.p. 112-3º (Calc. for $C_{21}H_{29}N_5O_7$: C, 54,41; H, 6,26. Found: C, 53,90; H, 5,80). There is an absence of carbonyl bands in the IR of this derivative.

Acknowledgment. - We wish to thank Dr. M. Rico of the Instituto Rocasolano (C.S.I.C.) for help in obtaining and interpreting the NMR spectra.

References

1. De Waard, E.R., Neeter, R., Pandit, U.K. and Huisman, H.O., *Rec. Trav. Chim.*, **87**, 572 (1968).
2. Clement, R.A., *J. Org. Chem.*, **25**, 1724 (1960). Ibid, **27**, 1115 (1962).
3. Kealy, T.J., *J. Amer. Chem. Soc.*, **84**, 966 (1962).
4. Chapman, O.L. and Dominianni, S.J., *J. Org. Chem.*, **31**, 3862 (1966); Adendri, G., De Sio, F. and Scotton, M., *J. Chem. Soc.*, (C) 2857 (1968).
5. Bohlman, F. and Schuman, D., *Tetrahedron Letters*, **2435** (1965).