

Heterocycles with a bridgehead nitrogen atom.

16.* Assembly of a *peri*-fused system from an angular tricycle by recyclization of an oxazole ring into pyrrole one

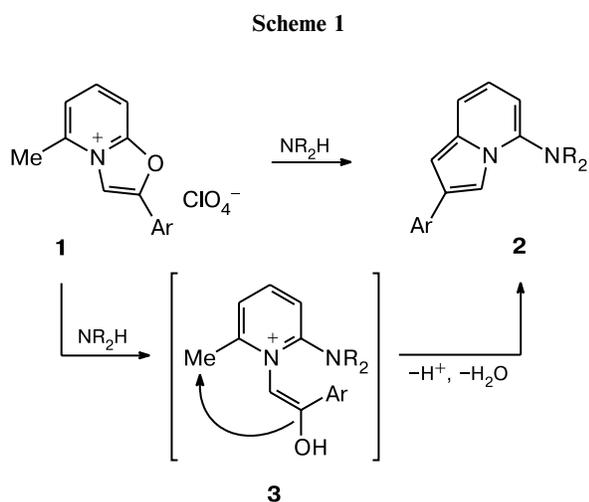
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An unusual example of the recyclization of the tricyclic 6,7,8,9-tetrahydrooxazolo[3,2-*a*]quinolinium system into the 8,9-dihydro-7*H*-pyrrolo[3,2,1-*ij*]quinoline system was discovered. The reaction is a topological modification of the known conversion of oxazolo[3,2-*a*]pyridinium salts into indolizines. The structural feature of this transformation is a change of the annelation type in the tricycle from the angular one to *peri*-fusion of three rings.

Key words: recyclization, oxazole, pyrrole, indolizine, annelation, *peri*-fused rings, X-ray diffraction analysis.

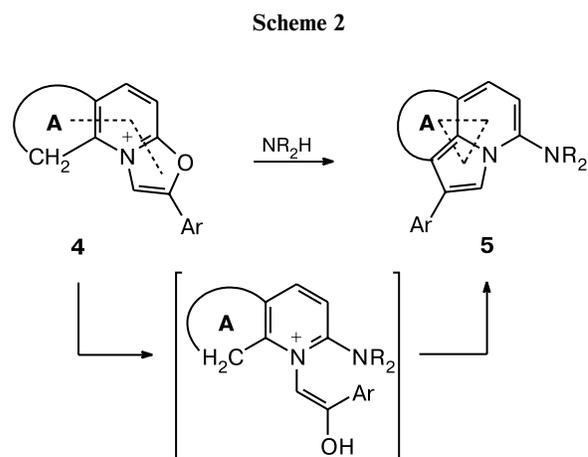
Earlier,^{2,3} we discovered a new family of recyclization reactions of the oxazole ring into the pyrrole one, through which fused oxazolo[3,2-*a*]pyridinium salts **1** were converted to 5-substituted indolizines **2** virtually inaccessible in any other ways (Scheme 1).



Most likely, the conversion proceeds⁴ through the formation of pyridinium intermediate **3**, in which cyclocondensation of a new pyrrole ring involves the α -methyl group of the salt **1**.

An interesting topological modification of this transformation could be conversion of tricyclic systems **4** containing a methylene fragment (as in cation **4**) as part of an

additional ring A instead of the methyl group (as in salts **1** and **3**) (Scheme 2). In this case, the ring A originally fused only with the pyridine ring of salt **4** would become additionally fused with a newly formed pyrrole ring to give system **5**. Therefore, the overall structural reconstruction of tricycles **4**→**5** would be an example of an extremely rare mode of transformation of an angular structure (three rings with two fused sides) into a *peri*-fused system (three rings are all fused in pairs).



We experimentally performed this unusual topological transformation with 6,7,8,9-tetrahydrooxazolo[3,2-*a*]quinolinium salt **6** as a tricyclic system of the type **4** (Scheme 3).

Tricycle **6** was synthesized in three steps starting from available tetrahydroquinolone **7**. To construct the oxazole

* For Part 15, see Ref. 1.

6a and **9a** were described earlier.⁶ Compound **7** was prepared according to a known procedure.¹⁰

2-Methoxy-4-methyl-5,6,7,8-tetrahydroquinoline (8). A mixture of 4-methyl-5,6,7,8-tetrahydroquinolin-2-one (**7**) (57 mmol), CH₃I (72 mmol), and freshly prepared and well dried Ag₂CO₃ (28.5 mmol) in 90 mL of benzene was refluxed for 50 to 60 h in a light-protected flask. The precipitate was filtered off, the solvent was removed from the mother liquor, and the residue was distilled *in vacuo* while collecting a fraction with b.p. 147 °C (20 Torr). The yield of compound **8** was 3.8 g (38%), m.p. 40–41 °C (*cf.* Ref. 6: m.p. 35–40 °C).

4-Methyl-1-(4-nitrophenyl)-5,6,7,8-tetrahydroquinolin-2-one (9b). A solution of compound **8** (25 mmol) and 4-nitrophenacyl bromide (20 mmol) in 40 mL of MeCN was refluxed for 40 h. The precipitate was filtered off and recrystallized from acetonitrile. The yield of compound **9b** was 3.56 g (55%), m.p. 194–196 °C. Found (%): N, 5.50. C₁₈H₁₈N₂O₄. Calculated (%): N, 5.56. ¹H NMR (DMSO-d₆), δ: 8.33 (m, 4 H, ArH); 6.14 (s, 1 H, H(3)); 5.52 (s, 2 H, NCH₂); 2.47 (m, 4 H, CH₂); 2.12 (s, 3 H, CH₃); 1.74 (m, 4 H, CH₂).

5-Methyl-2-(4-nitrophenyl)-6,7,8,9-tetrahydrooxazolo[3,2-a]quinolinium perchlorate (6b). Compound **9b** (5 mmol) was carefully dissolved in 30 mL of conc. H₂SO₄ and left at room temperature for 16 h. The mixture was carefully poured into 300 mL of water and allowed to cool. Then 70% HClO₄ (15 mL) was added dropwise. The precipitate was filtered off, washed with water to a neutral reaction, and dried. The yield of compound **6b** was 1.93 g (95%), m.p. 283–285 °C. Found (%): N, 6.75. C₁₈H₁₇N₂O₃·ClO₄. Calculated (%): N, 6.85. ¹H NMR (DMSO-d₆), δ: 9.62 (s, 1 H, H(1)); 8.50, 8.28 (both m, 2 H each, ArH); 8.23 (s, 1 H, H(4)); 3.13, 2.82 (both m, 2 H each, CH₂); 2.60 (s, 3 H, CH₃); 1.90, 1.99 (both m, 2 H each, CH₂).

Recyclization of salts 6 in the presence of secondary amines (general procedure). A secondary amine (1 mL, ~20-fold excess) was added to a solution of perchlorate **6** (0.5 mmol) in 10 mL of acetonitrile. The mixture was refluxed to give a crimson solution, which rapidly turned greenish yellow. The resulting solution was poured into water. The precipitate was filtered off, dried, and recrystallized from acetonitrile.

1-(4-Chlorophenyl)-6-methyl-4-piperidino-8,9-dihydro-7H-pyrrolo[3,2,1-ij]quinoline (10a) was obtained from perchlorate **6a** and piperidine. The reaction duration was 2 min. The yield of compound **10a** was 98%, m.p. 138–139 °C (yellow prismatic crystals). X-ray diffraction data are shown in Fig. 1. Found (%): N, 7.61. C₂₃H₂₅ClN₂. Calculated (%): N, 7.68. ¹H NMR (DMSO-d₆), δ: 7.51, 7.33 (both m, 2 H each, ArH); 7.18 (s, 1 H, H(3)); 5.76 (s, 1 H, H(6)); 3.00 (m, 4 H, CH₂); 2.95, 2.74 (both m, 2 H each, CH₂); 2.15 (s, 3 H, CH₃); 2.00 (m, 2 H, CH₂); 1.80, 1.67 (both m, 4 H each, CH₂).

6-Methyl-4-morpholino-1-(4-nitrophenyl)-8,9-dihydro-7H-pyrrolo[3,2,1-ij]quinoline (10b) was obtained from perchlorate **6b** and morpholine. The reaction duration was 4 h. The yield of

compound **10b** was 40%, m.p. 218–220 °C. Found (%): N, 11.05. C₂₂H₂₃N₃O₃. Calculated (%): N, 11.13. ¹H NMR (CDCl₃), δ: 8.25, 7.73 (both m, 2 H each, ArH); 7.40 (s, 1 H, H(3)); 5.88 (s, 1 H, H(6)); 3.95, 3.10 (both m, 4 H each, CH₂); 3.03, 2.80 (both m, 2 H each, CH₂); 2.19 (s, 3 H, CH₃); 2.06 (m, 2 H, CH₂).

4-Methoxy-6-methyl-1-(4-nitrophenyl)-8,9-dihydro-7H-pyrrolo[3,2,1-ij]quinoline (11b). Perchlorate **6b** (0.5 mmol) was added to a solution of MeONa in methanol (prepared from Na metal (7.4 mmol) and anhydrous MeOH (10 mL)). The reaction mixture was left for 16 h. The precipitate that formed was filtered off and recrystallized from acetonitrile. The yield of compound **11b** was 0.10 g (62%), m.p. 183–185 °C. Found (%): N, 8.50. C₁₉H₁₈N₂O₃. Calculated (%): N, 8.69. ¹H NMR (CDCl₃), δ: 8.23, 7.72 (both m, 2 H each, ArH); 7.48 (s, 1 H, H(3)); 5.56 (s, 1 H, H(6)); 4.02 (s, 3 H, OCH₃); 3.02, 2.77 (both m, 2 H each, CH₂); 2.19 (s, 3 H, CH₃); 2.05 (m, 2 H, CH₂).

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