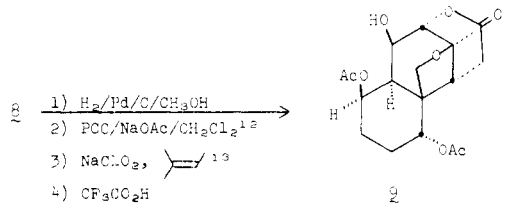

absorptions at 3510 and 1730 cm^{-1} and ^1H NMR absorptions at δ 1.51, 2.06, and 2.10 support the assignment of structure **9**.

Structure **9** contains seven contiguous asymmetric centers found in quasimarin and is available in 13% yield from **2**. We expect that this compound will serve as a key intermediate for the synthesis of quasimarin.

Acknowledgment is made to the donors of the Petroleum Research Fund, administered by the American Chemical Society, for partial support of research. research.

Registry No. **2**, 72827-04-4; **3**, 72826-90-5; **4**, 72844-64-5; **5**, 72844-65-6; **6**, 72844-66-7; **7**, 72844-67-8; **8**, 72844-68-9; **9**, 72844-69-0; methyl gentisate, 2150-46-1.

(14) Fellow of the Alfred P. Sloan Foundation, 1979–1981.
(15) Compounds **4**, **5**, **6**, **7**, **8**, and **9** exhibited satisfactory high-resolution mass spectra and combustion analyses.

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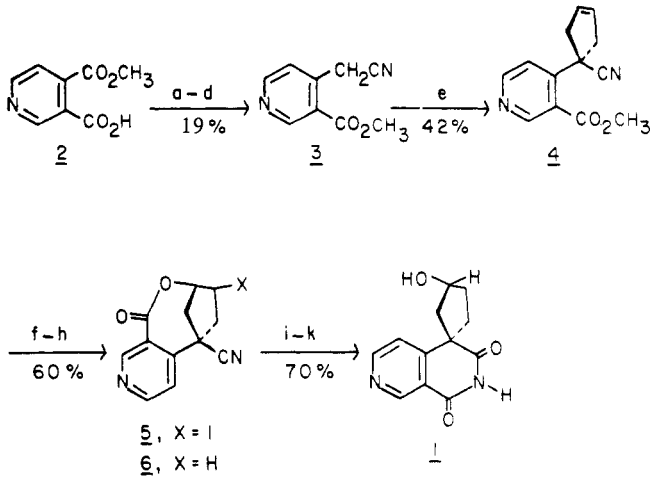
Total Synthesis of Racemic Sesbanine

Summary: A stereospecific total synthesis of racemic sesbanine (**1**) from 4-(methoxycarbonyl)nicotinic acid is described.

Sir: Powell and co-workers have reported antileukemic activity associated with extracts from seeds of *Sesbania drummondii*, a native plant with a history of toxicity to livestock.[1] Extensive purification procedures, guided by in vivo (P388 leukemia) and in vitro (KB cell culture) bioassays, ultimately resulted in isolation of sesbanine (**1**), a new spirocyclic structure based on the 2,7-naphthyridine nucleus; the structure of **1** was established by X-ray crystallography.[2]

In view of the unusual structure of **1** and the possibility that potent antileukemic activity might be associated with such a structure, we have developed a stereospecific synthesis of racemic **1** as outlined in Scheme I. 4-(Methoxycarbonyl)nicotinic acid (**2**),[3] available from methanolysis of 3,4-pyridinedicarboxylic anhydride, reduced with $LiAlH_4$ to afford 4-(hydroxymethyl)nicotinic acid, an unstable substance with a propensity to lactonize. The crude hydroxymethyl acid was converted to cyano ester

Scheme I[a]



[a] (a) $LiAlH_4$, THF; (b) PCl_5, CH_2Cl_2; (c) CH_3OH; (d) NaCN, Aliquat 336, CH_2Cl_2; (e) (*Z*)-1,4-dichlorobut-2-ene, NaH, THF; (f) NaOH, H_2O/THF; (g) I_2, KI, $NaHCO_3$, H_2O/CH_2Cl_2; (h) *n*-Bu_3SnH, AIBN, C_6H_6; (i) NH_3, CH_3OH; (j) NaH, *i*-PrOH; (k) H_3O^+.

3[4] by reaction with PCl_5 to afford the chloromethyl acyl chloride, methanolysis of the acyl chloride, and displacement of the primary chloride by CN^-. The intermediate chloro derivatives are too reactive for purification. Cyclization of **3** with (*Z*)-1,4-dichlorobut-2-ene afforded **4** (85% pure) that contained a small amount of the corresponding vinyl cyclopropyl derivative.[5] Purification of **4**[4] by chromatography on silica gel was useful for characterization, but crude **4** was satisfactory for further transformations.

Stereospecific introduction of the hydroxyl group was effected by the iodolactonization reaction. Ester **4** was saponified as indicated in Scheme I, $I_2/KI/HCO_3^-$ in H_2O/CH_2Cl_2 was added to the saponification mixture, and the two-phase mixture was stirred in the dark for 4 days to afford iodo lactone lactone **5** as a light-sensitive substance that was reduced to lactone **6**[4] with *n*-Bu_3SnH. Aminolysis of lactone **6**, intramolecular addition of the amide anion to the nitrile group, and hydrolysis to the imide by workup with aqueous acid afforded racemic **1**.[4,6]

Acknowledgment. Financial support from the National Institutes of Health, Grant No. 2 R01 GM19103, is gratefully acknowledged.

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(4) Satisfactory analytical data (combustion and high-resolution mass spectrum) have been obtained for **1**, **3**, **4**, and **6**. High-resolution mass spectra were provided by the facility supported by National Institutes of Health Grant RR00317 (principal investigator, Professor K. Biemann) from the Biotechnology Resources Branch, Division of Research Resources. For **3**: mp 100–101 °C; IR (CCl_4) 2250, 1725 cm^{-1}; ^1H NMR ($CDCl_3$) δ 4.11 (s, 3 H, OCH_3), 4.42 (s, 2 H, CH_2CN), 7.79 (d, 1 H, J = 5 Hz, py H_5), 8.96 (d, 1 H, J = 5 Hz, py H_6), 9.39 (s, 1 H, py H_2). For **4**: IR (CCl_4) 2240, 1730 cm^{-1}; ^1H NMR δ 2.16 (br s, 4 H, allylic H), 3.94 (s, 3 H, OCH_3), 5.79 (br s, 2 H, vinyl H), 7.25 (d, 1 H, J = 5 Hz, py H_5), 8.58 (d, 1 H, J = 5 Hz, py H_6), 8.80 (s, 1 H, py H_2). For **6**: mp 210–212 °C; IR ($CHCl_3$) 2250, 1705 cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.8–2.8 (m, 6 H, aliphatic H), 5.20 (m, 1 H, OCH<), 7.76 (d, 1 H, J = 5 Hz, py H_5), 8.80 (d, 1 H, J = 5 Hz, py H_6), 9.51 (s, 1 H, py H_2).
(5) Schmid, G. H.; Wolkoff, A. W. *J. Org. Chem.* **1967**, *32*, 254.
(6) The IR (KBr), mass, and ^{13}C NMR spectra (Me_2SO-d_6) of synthetic **1** (mp 239–241 °C) were identical with those of the natural material except that, whereas C-5 and C-8a gave overlapping signals in the ^{13}C NMR spectrum of the natural material,[2] we observed separate signals at 119.7 (C-8a) and 121.8 (C-5) ppm. We thank Dr. R. G. Powell for providing authentic spectral data.

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Received November 14, 1979