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Synthetic Studies on Tetrahydropyrroloquinoline-containing Natural Products: Syntheses of Discorhabdin C, Batzelline C and Isobatzelline C

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Abstract: Discorhabdin C (1), batzelline C (2) and isobatzelline C (3), metabolites of marine sources sharing a tetrahydropyrroloquinoline core, have been successfully synthesized, and cytotoxicities of several synthetic intermediates were evaluated.

Among physiologically active substances isolated from marine sources, the pyrroloquinoline alkaloid family consisting of prianosins[1] [*Prianos melanos*: discorhabdins[2] (*Latrunculia* du Bocage, *Latrunculia brevis* and *Prianos* sp.)], batzellins (*Batzella* sp.),[3] wakayin (*Clavelina* sp.),[4] damirones (*Damiria* sp.)[5] and makaluvamines (*Zyzzya* cf. *marsailis* and *Histodermella* sp.)[6] exhibits antitumor activities derived from the unique highly-fused structures. Particularly, the novel sulfur-containing alkaloid structure of prianosin A (discorhabdin A) has served a challenging target to many synthetic groups.[7] In this context, as a part of our synthetic investigation of biologically active natural products, we initiated a synthesis of this molecule employing our biomimetic phenolic oxidation with an anodic oxidation or a thallium (III) salt,[8] particularly, for the construction of the spiro moiety. In the course of the research, we achieved the first total synthesis of discorhabdin C (**1**) sharing the fundamental skeleton with prianosin A with the exception of a sulfur atom.[9] In addition, a slight modification of the synthetic route allowed to synthesize other members of the alkaloid family, batzelline C (**2**) and isobatzelline C (**3**).[10] We describe herein our synthetic process, coupled with the cytotoxic activities of the several synthetic intermediates.

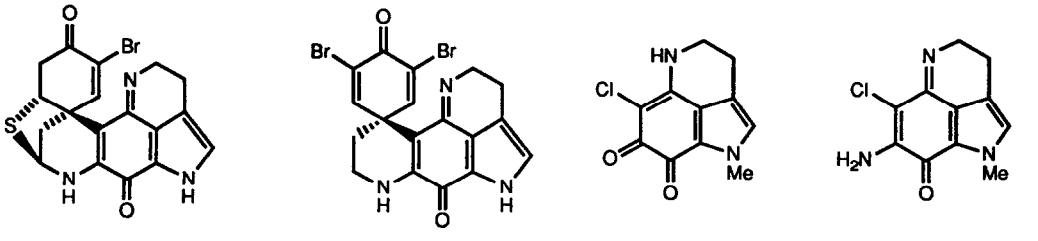


Figure 1. The structures of the tetrahydropyrroloquinoline alkaloids.

RESULTS AND DISCUSSIONS

Synthesis of discorhabdin C (1). Previously, attempts of synthesis of **1** by construction of the iminoquinone at the final stage (route **A**) were unsuccessful,[7d] probably owing to an unstable character of the spirodienone residue under reaction conditions. Accordingly, we employed route **B** where the synthesis would be accomplished with an oxidation of the phenol possessing the iminoquinone residue (Fig. 2).

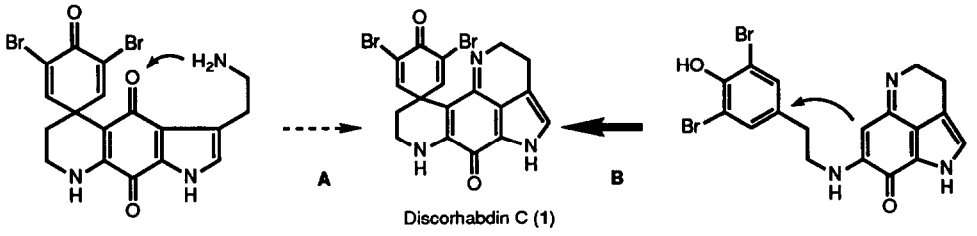
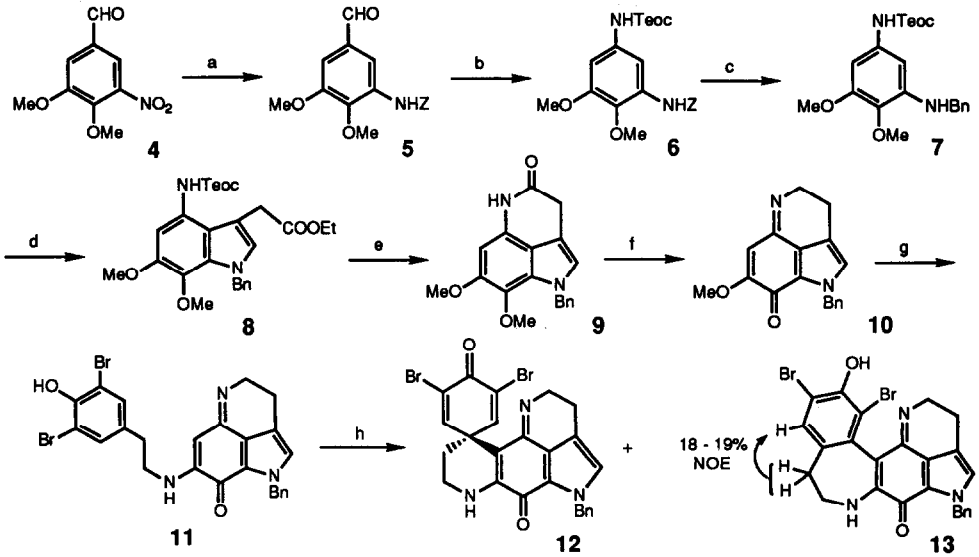


Figure 2. The synthetic approaches to discorhabdin C (**1**).

With these prospects in mind, the synthesis was initiated from conversion of the known nitrobenzaldehyde (**4**)[11] into the corresponding amide (**5**). Manipulation of **5** involving Curtius reaction provided diaminobenzene **6**, whose two amino functions could be differentiated by the diverse protective groups. Thus, after reductive removal of the benzyloxycarbonyl group, the amine generated was benzylated by a usual manner to give **7**. Among a variety of methods for indole-skeleton constructions, we chose reaction of **7** with ethyl 4-chloroaceto-

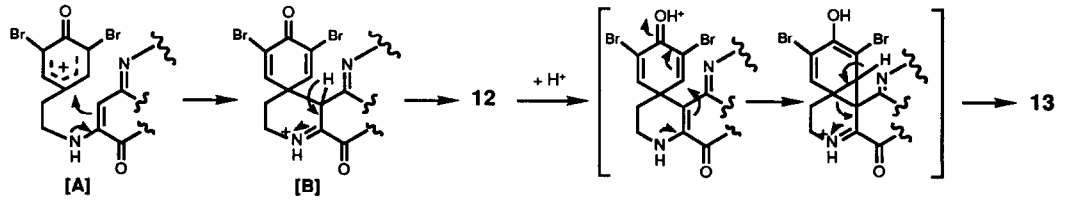


a. i) Fe, HCl; ii) ZCl, Na_2CO_3 (67%). b. i) Jones oxid. (93%); ii) Imd_2CO; iii) NaN_3, then heat; iv) trimethylsilylethanol (87%). c. i) H_2, 10% Pd-C (100%); ii) PhCHO, $NaBH_3CN$ (81%). d. ethyl 4-chloroacetoacetate (85%). e. i) nBu_4NF (75%); ii) KOH, then DCC (81%). f. i) $BH_3{\cdot}SMe_2$; ii) CAN (50%). g. 3,5-dibromotyramine (78%). h. $LiClO_4$, CCE at 3 mA (**12**, 19.3 %: **13**, 9.2 %).

Scheme 1. Synthesis of benzyldiscorhabdin C (**12**).

acetate, which gave rise to a simultaneous introduction of a C_2 unit at the C-3 position of the indole (**8**). An access to the tetrahydropyrroloquinoline molecule was effected by Gannortt's procedure[12] for the synthesis of dehydrobufotenine; stepwise removal of the amino and carboxylic acid protective groups of **8**, followed by lactam formation provided the tricyclic product (**9**) in good overall yield. The amide function of **9** was reduced with BH_3•SMe_2, and the resulting amine was oxidized with CAN (ceric ammonium nitrate) to produce the expected tetrahydropyrroloquinoline (**10**) in 50% yield in two steps, which was further submitted to nucleophilic substitution reaction with 3,5-dibromotyramine to furnish **11** in 78% yield.

Based on our extensive research related to phenolic oxidations,[8] two methodologies [anodic oxidation and thallium (III)] are in hand; the former has usually provided spirodienone products in better yields. Actually, as reported in the preceding paper,[7d] model studies suggested that electrochemical oxidation is a method of choice. Thus, electrolysis of bromophenol **11** furnished the expected benzyldiscorhabdin C (**12**) coupled with the ring-expanded product (**13**) in 19 and 9.2 % yields, respectively. The connection of the dibromophenol residue of **13** was confirmed by the NOE experiment as shown in Scheme 1. A plausible reaction mechanism is that an enamine-type cyclization of the cationic intermediate [**A**] generated by the two electron oxidation, provides the iminium compound [**B**], which undergoes a proton abstraction to produce **12**. Under the phenolic oxidation conditions, **12** suffers a ring expansion to the undesired phenol (**13**). The production of the only one isomer (**13**) suggested that the ring-expansion reaction is assisted by an electron donation of the nitrogen as depicted in Scheme 2.

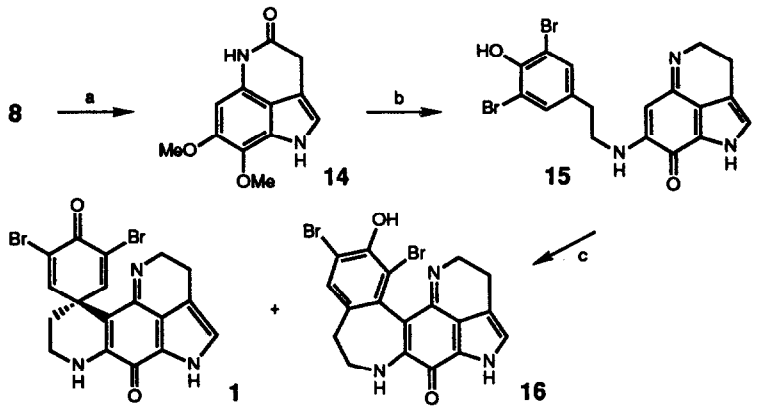


Scheme 2. A plausible reaction mechanism of the formation of **13**

Unfortunately in the last step, all efforts[13] made to remove the benzyl protective group of **12** were unsuccessful. During further elaboration of anodic oxidations of these tetrahydropyrroloquinoline derivatives, the N_1-nitrogen was found to be intact even as a free state under the reaction conditions. Therefore, we synthesized the bromophenol derivative (**15**) as follows.

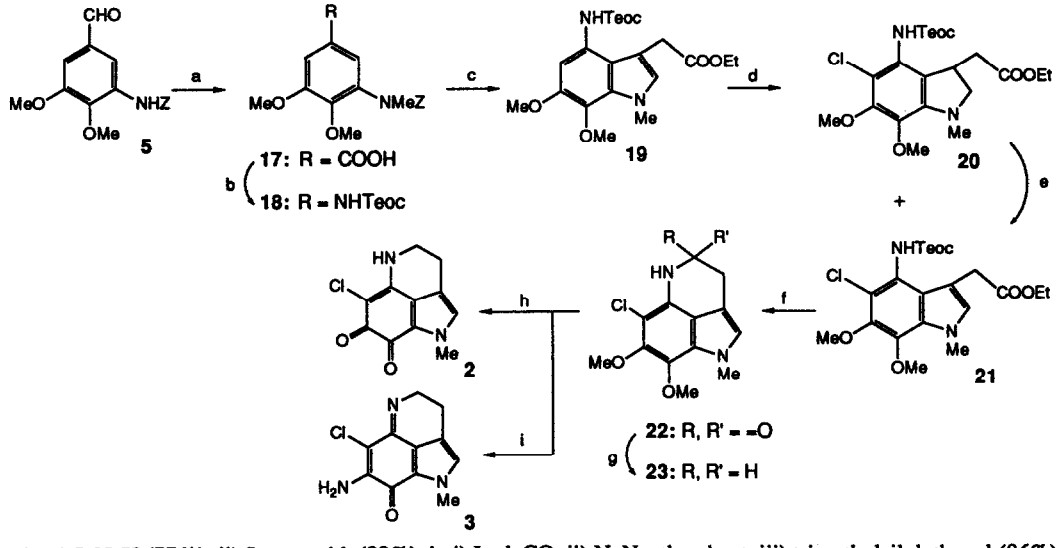
The indole (**8**) was hydrogenated under acidic conditions to remove the benzyl and Teoc (2-trimethylsilyl-ethoxycarbonyl) protective groups, followed by lactamization as in the case of **9**, yielding **14**. Conversion of **14** into **15** proceeded smoothly according to synthesis of **11**. Upon anodic oxidation, **15** produced the desired discorhabdin C (**1**) and the corresponding ring-expanded product (**16**) in 24 and 6.2 % yields, respectively. All of the spectral data of synthetic **1** were identical with those of the natural product.[2a,b]

Syntheses of batzelline C (2) and isobatzelline C (3). As can be seen in Scheme 4, the synthetic process toward **2** and **3** employed essentially the same manner as that of **12** until the lactam (**22**) possessing a chlorine atom and a methyl group at C-6 and -1 positions. Thus, compound **5** was converted into the corresponding indole (**19**) through **17** and **18**. In order to avoid an over-chlorination in the following step, **19** was selectively reduced with $NaBH_3CN$, followed by chlorination with NCS (N-chlorosuccinimide), leading to a



a. i) H_2, Pd-black, 60% $HClO_4$; ii) KOH, then DCC (36%). b. i) BH_3·SMe_2; ii) CAN (51%); iii) 3,5-dibromotyramine (74%). c. $LiClO_4$, CCE at 3 mA (**1**, 24%: **16**, 6%).

Scheme 3. Synthesis of discorhabdin C (**1**).



a. i) MeI, NaH (77%); ii) Jones oxid. (89%). b. i) Imd_2CO; ii) NaN_3, then heat; iii) trimethylsilylethanol (86%). c. i) H_2, 10% Pd-C (100%); ii) ethyl 4-acetoacetate (87%). d. i) $NaBH_3CN$ (80%); ii) NCS (**20**, 69%: **21**, 6 %). e. DDQ (66%). f. i) 60% $HClO_4$; ii) NaOH; iii) DCC (58%). g. BH_3·SMe_2 (80%). h. BBr_3 (78%). i. i) CAN (64%); ii) NH_4Cl (64%).

Scheme 4. Syntheses of batzelline C (**2**) and isobatzelline C (**3**).

mixture of the expected indoline (**20**) and the chloroindole (**21**) which might suffer autoxidation during the isolation procedure. DDQ (2,3-dichloro-5,6-dicyano-1,4-benzoquinone) oxidation effected transformation of **20** into **21** in good yield. After deprotection of **21**, cyclization with DCC produced the lactam (**22**), which was submitted to reduction with BH_3·SMe_2 to yield **23** carrying a pyrroloquinoline skeleton. Upon deprotection with BBr_3, the diphenol generated was exposed to air to furnish batzelline C (**2**). On the other hand, upon CAN oxidation, **23** provided the corresponding iminoquinone, which was then subjected to amination with NH_4Cl to

furnish isobatzelline C (**3**). Noteworthy is this substitution reaction (MeO → NH_2) required a protonation probably at the imino-nitrogen to activate the C-7 position. Actually, the substitution reaction could not be observed under basic conditions (NH_3 / MeOH or aq. NH_4OH).

Cytotoxic activities. Discorhabdin C (**1**) is known to show a potent cytotoxicity (P388, 0.03 μg/ml).[2b] In addition, isobatzellines were cytotoxic (the values were not described), while batzellines possessing orthoquinone moieties exhibited no activities.[3b,6a] From these findings, our attention was focused on the related derivatives synthetically obtained. Thus, as can be seen in Table 1, the synthetic intermediates (**9**, **11**, **12**, **13**, **15**, **22** and **23**) and isobatzelline C (**3**) were submitted to an evaluation of cytotoxic activities against HeLa S_3 cell line. It was observed that the compounds involving an iminoquinone structure (**3**, **11**, **12**, **13** and **15**) exhibited moderate cytotoxicities, contrary to other samples. Additionally, compound **15** is a dibromo derivative of makaluvamine D which also showed moderate activities against HCT-116 and xrs-6 cell lines.[6a] Comparison of these results might indicate that halogen atoms would not give a significant effect to cytotoxicities, although the diverse lines were used. The unnatural benzazepin residue of **13** showed a similar effect to that of the dibromotyramine unit of **11**, although the activity was one order lower than that of the spirodienone of **12**.

Further investigation on biological activities including inhibitory activities against topoisomerases I and II is in progress.

Table 1. Cytotoxic activities of the synthetic intermediates and isobatzelline C against HeLa S_3 cell line.

compound	**3**	**9**	**11**	**12**	**13**	**15**	**22**	**23**
IC_{50} (μg / ml)	5.65	>100	32.5	1.44	11.6	5.53	>100	>100

EXPERIMENTAL

All of the melting points were obtained on a Mitamura Riken melting point apparatus and are uncorrected. IR spectra were recorded on a JASCO Model A-202 spectrophotometer. ^1H NMR and ^{13}C NMR spectra were obtained on a JEOL FX-90 A, a JEOL JNM EX-270 or a JEOL JNM GX-400 NMR spectrometer in a deuteriochloroform ($CDCl_3$) solution using tetramethylsilane as an internal standard, unless otherwise stated. High resolution mass spectra were obtained on a Hitachi M-80 GC-MS spectrometer operating at the ionization energy (70 eV). Preparative and analytical TLC were carried out on silica gel plates (Kieselgel 60 F_{254}, E. Merck A. G., Germany) using UV light and/or 5% molybdophosphoric acid in ethanol for detection. Katayama silica gel (K 070) was used for column chromatography. The anodic oxidation was carried out using a 30 ml glassy carbon beaker as the anode and a platinum wire as the cathode.

3-Benzyloxycarbonylamino-4,5-dimethoxybenzaldehyde (5). A mixture of 4,5-dimethoxy-3-nitrobenzaldehyde[11] (**4**, 20.0 g, 0.01 mol) and iron dust (16 g, 0.29 mol) in MeOH (400 ml) in the presence of 12M HCl (16 ml) was stirred at refluxing temperature for 10 h. The reaction mixture was filtered, and the filtrate was evaporated to give a residue, which was diluted with H_2O (300 ml), and washed with EtOAc (300 ml x 3). The aqueous layer was adjusted to pH 9 ~ 10 by the addition of 3 M NH_4OH; the mixture was extracted with EtOAc (300 ml x 3). After evaporation of the organic extracts, the residue was dissolved in a mixture of ether (300 ml) and H_2O (300 ml). To the ice-cooled mixture were added Na_2CO_3 (20 g, 0.19 mol) and

benzyloxycarbonyl chloride (25 ml, 0.15 mol); the resulting mixture was stirred at the same temperature for 30 min, then at room temperature for further 2 h. After separation of the ether, the aqueous layer was extracted with ether (200 ml x 2). The combined ethereal solution was successively washed with H_2O and brine, dried (Na_2SO_4), then evaporated to give a yellow syrup. The crude product was chromatographed on a silica gel column (hexane/EtOAc=4:1) to yield **5** (20.1 g, 67%) as colorless crystals, mp 97 - 98 °C (from hexane - EtOAc); IR (nujol) 1735, 1695, and 1595 cm^{-1}; δ_H 3.92 (3H, s), 3.95 (3H, s), 5.23 (2H, s), 7.20 (1H, d, J= 2 Hz), 7.30 - 7.45 (6H, complex), 8.34 (1H, d, J= 2 Hz), and 9.88 (1H, s); δ_C 55.6 (q), 60.5 (q), 66.9 (t), 104.6 (d), 115.2 (d), 128.1 (d), 128.3 (d), 131.9 (s), 132.1 (s), 135.6 (s), 141.5 (s), 152.1 (s), 152.8 (s), and 191.0 (s). Calcd for $C_{17}H_{17}NO_5$: C 64.78, H 5.36, N 4.40 %. Found: C 64.75, H 5.43, N 4.44 %.

1-Benzyloxycarbonylamino-2,3-dimethoxy-5-(2-trimethylsilylethoxy)carbonylaminobenzene (6). To an ice-cooled solution of **5** (15.8 g, 50 mmol) in acetone (200 ml) was gradually added Jones reagent (26 ml); the mixture was stirred at 0 °C for 30 min and at room temperature for further 1 h. After the addition of isopropanol to destroy excess reagents, the resulting mixture was filtered, and solid materials were washed with acetone (100 ml), the filtrate and the washings were combined, and concentrated under reduced pressure to dryness. The crude product was purified by silica gel chromatography ($CHCl_3$ graded to $CHCl_3$/MeOH=9:1) to give the corresponding carboxylic acid (15.5 g, 93%) as a white solid.

A mixture of the carboxylic acid (15.2 g, 50 mmol) and carbonyl diimidazole (8.93 g, 55 mmol) in anhydrous THF (115 ml) was stirred at room temperature for 2 h under an argon atmosphere. To the reaction mixture was added 4M aq. NaN_3 (50 ml). After being vigorously stirred for 2 h, the mixture was poured into cold H_2O (300 ml), and extracted with ether (300 ml x 3). The organic extracts were washed with H_2O and brine, then dried (Na_2SO_4). Removal of the solvent gave a residue (15.1 g), which was heated at refluxing temperature in PhMe (90 ml). After 30 min, evolution of nitrogen was ceased, and the reaction mixture was cooled to 60 °C, then trimethylsilylethanol (9 ml, 63 mmol) was added. The resulting mixture was stirred at the same temperature for 2 h, and evaporated. The residue was chromatographed on a silica gel column (hexane/EtOAc=17:3) to provide **6** (17.8 g, 87%) as a colorless oil; IR (film) 1725 and 1610 cm^{-1}; δ_H 0.06 (9H, s), 1.04 (2H, complex), 3.79 (3H, s), 3.87 (3H, s), 4.24 (2H, complex), 5.20 (2H, s), 6.55 (1H, br s), 7.26 (1H, br s), and 7.3 - 7.5 (7H, complex); δ_C -1.8 (q), 17.4 (t), 55.4 (q), 60.4 (q), 62.9 (t), 66.8 (t), 97.8 (d), 100.8 (d), 128.0 (d), 128.2 (d), 131.4 (s), 132.4 (s), 134.7 (s), 135.7 (s), 151.8 (s), 153.0 (s), and 153.7 (s). Calcd for $C_{22}H_{30}N_2O_6Si$: m/z 446.1871, M+. Found: 446.1862.

1-Benzylamino-2,3-dimethoxy-5-(2-trimethylsilylethoxy)carbonylaminobenzene (7). A solution of **6** (16.0 g, 36 mmol) in EtOH (150 ml) was hydrogenated over 10% Pd-C (1.2 g) at atmospheric pressure for 2 h. The reaction mixture was filtered, and the filtrate was evaporated to give the amine (11.2 g, 100%).

A mixture of the amine (10.6 g, 34 mmol) and benzaldehyde (6 ml) in MeCN (100 ml) was stirred at 50 °C for 1 h. The solution was cooled to room temperature, and $NaBH_3CN$ (2.75 g, 44 mmol) was gradually added with continuous stirring, and the resulting mixture was again heated at 50 °C. The reaction was maintained at pH 7 ~ 8 by occasional additions of AcOH. After 12 h, the reaction mixture was poured into ice-water (300 ml), and extracted with EtOAc (300 ml x 3). The organic extracts were washed with saturated aq. $NaHCO_3$ and brine, dried (Na_2SO_4), and evaporated. The crude product obtained was chromatographed on a silica gel column (hexane/EtOAc=9:1) to give **7** (11.1 g, 81%) as an oil: IR (film) 1705, 1610 and 1520 cm^{-1}; δ_H 0.05 (9H, s), 1.01 (2H, complex), 3.77 (3H, s), 3.83 (3H, s), 4.21 (2H, complex), 4.31 (2H, s), 4.80 (1H, br s), 6.16 (1H, d, J= 2 Hz), 6.44 (1H, br s), 6.63 (1H, br s) and 7.25 - 7.34 (5H, complex); δ_C -1.5 (q), 17.7 (t), 47.8 (t), 55.6 (q), 59.9

(q), 63.1 (t), 92.9 (d), 95.1 (d), 127.1 (d), 127.4 (d), 128.5 (d), 131.2 (s), 135.2 (s), 139.4 (s), 142.2 (s), 152.4 (s), and 154.0 (s). Calcd for $C_{21}H_{30}N_2O_4Si$: m/z 402.1182, M+. Found: 402.1191.

1-Benzyl-6,7-dimethoxy-3-ethoxycarbonylmethyl-4-(2-trimethylsilylethoxy)carbonylaminoindole (8). A mixture of **7** (9.28 g, 23 mmol) and ethyl 4-chloroacetoacetate (15 g, 91 mmol) in anhydrous EtOH (100 ml) containing Molecular sieves 3A (4 g) was heated at refluxing temperature for 3 days. The reaction mixture was filtered, and the filtrate was evaporated to give a residue, which on chromatographic purification (hexane/EtOAc=5:1) furnished **8** (10.1 g, 85%) as a pale yellow oil; IR (film) 3300, 1720, 1620, and 1520 cm^{-1}; δ_H 0.06 (9H, s), 1.00 - 1.31 (2H, complex), 1.27 (3H, t, J= 7 Hz), 3.60 (3H, s), 3.73 (2H, s), 3.90 (3H, s), 4.05 - 4.25 (2H, complex), 4.26 (2H, q, J= 7 Hz), 5.50 (2H, s), 6.80 (1H, s), 7.00 - 7.30 (5H, complex), 7.30 (1H, s) and 8.79 (1H, br s); δ_C -1.6 (q), 13.8 (q), 17.5 (t), 32.3 (t), 51.4 (t), 56.8 (q), 60.9 (q), 61.3 (t), 62.9 (t), 102.6 (d), 105.9 (s), 117.5 (s), 125.7 (s), 126.2 (d), 127.0 (d), 128.3 (d), 128.6 (d), 130.6 (s), 132.4 (s), 138.8 (s), 147.7 (s), 155.0 (s), and 173.6 (s). Calcd for $C_{27}H_{36}N_2O_6Si$: m/z 512.2340, M+. Found: 512.2347.

1-Benzyl-7,8-dimethoxy-1,3,4,5-tetrahydropyrrolo[4,3,2-*de*]quinolin-4-one (9). To a solution of **8** (2.68 g, 5 mmol) in THF (40 ml) was added 1M nBu_4NF in THF (10 ml). After being stirred at room temperature for 5 h, the reaction mixture was concentrated under reduced pressure. The residue was purified by silica gel flash chromatography (hexane/EtOAc=7:3) to yield the amine (1.43 g, 75%) as an oil.

To a solution of the amine (1.78 g, 4.9 mmol) in MeOH (10 ml) was added 5 M KOH (1.2 ml, 6 mmol), and the reaction mixture was stirred at room temperature for 3 h under an argon atmosphere. After neutralization (pH 6 ~ 7) by the addition of AcOH, the mixture was filtered; the filtrate was diluted with H_2O (30 ml), and extracted with $CHCl_3$. The organic layer was dried (Na_2SO_4), and evaporated to give the crude carboxylic acid (1.55 g). To an ice-cooled solution of the product in anhydrous THF (100 ml) was added DCC (2.33 g, 11.3 mmol), and the reaction mixture was gradually warmed up to room temperature. After being stirred overnight, the solvent was removed under reduced pressure; the residue was chromatographed on a silica gel column (hexane/EtOAc=1:3) to give **9** (1.26 g, 81%) as an amorphous solid: IR (film) 1665, 1645, and 1615 cm^{-1}; δ_H 3.67 (3H, s), 3.87 (3H, s), 3.96 (2H, d, J= 2 Hz), 5.46 (2H, s), 6.16 (1H, s), 6.61 (1H, t, J= 2 Hz), 7.10 - 7.30 (5H, complex) and 8.95 (1H, br s); δ_C 31.3 (t), 51.3 (t), 57.9 (q), 61.3 (q), 92.4 (d), 106.9 (s), 112.6 (s), 122.1 (d), 126.7 (d), 127.1 (s), 127.4 (d), 128.5 (s), 128.6 (d), 138.8 (s), 149.7 (s), and 170.6 (s). Calcd for $C_{19}H_{18}N_2O_3$: m/z 322.1316, M+. Found: 322.1319.

1-Benzyl-7-{[2-(3,5-dibromo-4-hydroxyphenyl)ethyl]amino}-1,3,4,8-tetrahydropyrrolo[4,3,2-*de*]-quinolin-8-one (11). A mixture of **9** (536 mg, 1.7 mmol) and BH_3•SMe_2 (0.3 ml, 3.2 mmol) in THF (10 ml) was kept at room temperature for 5 h under an argon atmosphere. The resulting mixture was diluted with H_2O (10 ml), and extracted with EtOAc (20 ml x 3). The organic extracts were dried (Na_2SO_4), and evaporated to give an unstable yellow oil. To a solution of the product in 60% aq. MeCN (15 ml) was added CAN (2.63 g, 4.8 mmol) in 60% aq. MeCN (5 ml). After 5 min, the reaction mixture was evaporated to remove the MeCN, and H_2O (20 ml) was added. The resulting aqueous solution was extracted with chloroform (30 ml x 4), and the organic layer was dried (Na_2SO_4), then evaporated to give a reddish residue. Chromatographic purification ($CHCl_3$/MeOH=9:1) afforded the unstable iminoquinone (**10**, 243 mg, 50%) as a yellowish green solid: IR (nujol) 1655, 1610, 1565 and 1545 cm^{-1}; δ_H 2.71 (2H, t, J= 8 Hz), 3.82 (3H, s), 4.13 (2H, t, J= 8 Hz), 5.47 (2H, s), 6.08 (1H, s), 6.72 (1H, s), and 7.30 (5H, complex).

To a stirred solution of the iminoquinone (155 mg, 0.53 mmol) in anhydrous EtOH (25 ml) were added 3,5-dibromotyramine hydrobromide (300 mg, 0.80 mmol) and $NaHCO_3$ (300 mg, 3.5 mmol), and the stirring was continued at room temperature for 3 h. The resulting mixture was filtered and the solid was washed with MeOH.

The filtrate and the washings were combined, and evaporated to give a purple colored residue. Purification by preparative TLC ($CHCl_3$/MeOH=9:1) provided **11** (230 mg, 78%) as a purple colored solid: IR (nujol) 1665, 1620, 1595, and 1545 cm^{-1}; δ_H (CD_3OD) 2.88 (2H, t, J= 7.2 Hz), 2.97 (2H, t, J= 7.6 Hz), 3.58 (2H, t, J= 7.2 Hz), 3.87 (2H, t, J= 7.6 Hz), 5.42 (1H, s), 5.53 (2H, s), 7.32 (1H, s), 7.39 (5H, complex), and 7.40 (2H, s); δ_C (CD_3OD) 20.3 (t), 34.4 (t), 44.8 (t), 46.8 (t), 54.2 (t), 86.6 (d), 113.4 (s), 121.0 (s), 125.1 (s), 125.2 (s), 129.7 (d), 130.2 (d), 130.7 (d), 132.1 (d), 133.6 (s), 134.6 (d), 138.6 (s), 152.8 (s), 155.8 (s), 159.8 (s), and 169.8 (s); m/z 557 (1.1), 555 (1.9), 553 (0.9), 466 (0.6), 464 (0.9), 462 (0.5), 288 (8), 275 (14), 173 (12), 118 (17), and 91 (100).

Benzyldiscorhabdin C (12) and 5-benzyl-11,13-dibromo-2,3,5,7,8,9-hexahydro-12-hydroxy-6H-pyrrolo[4',3',2':4,5]quino[8,7-a][3]benzazepin-6-one (13). A solution of **11** (26 mg, 0.05 mmol) in anhydrous MeCN (25 ml) in the presence of $LiClO_4$ (200 mg) was electrolyzed at a constant current (3 mA, 1700 → 1800 mV *vs.* SCE) for 1 h (2.4 F/mol) under an argon atmosphere. The reaction mixture was evaporated, and the residue was separated by preparative TLC ($CHCl_3$/MeOH/conc NH_4OH=10:1:0.1) to give **12** (5.0 mg, 19.3%) and **13** (2.4 mg, 9.2%) as amorphous solids, respectively. **12**: IR (film) 1680 - 1635, 1565, and 1530 cm^{-1}; δ_H (CD_3OD) 2.04 (2H, t, J= 5.6 Hz), 2.72 (2H, t, J= 7.6 Hz), 5.53 (2H, t, J= 5.6 Hz), 7.16 (1H, br s), 7.33 (5H, m), and 7.71 (2H, s). Calcd for $C_{25}H_{19}N_3O_2{}^{79}Br^{81}Br$: m/z 552.9823, M^+. Found: 552.9823. **13**: IR (film) 1655, 1595, and 1535 cm^{-1}; δ_H (CD_3OD) 2.83 (2H, t, J= 6.7 Hz), 2.86 (2H, t, J= 7.6 Hz), 3.99 (2H, t, J= 7.6 Hz), 4.12 (2H, t, J= 6.7 Hz), 5.49 (2H, s), 7.16 (1H, s), and 7.36 (6H, m). Calcd for $C_{25}H_{20}N_3O_2{}^{79}Br_2$: m/z 551.9922, $(M+H)^+$. Found: 551.9895.

7,8-Dimethoxy-1,3,4,5-tetrahydropyrrolo[4,3,2-*de*]quinolin-4-one (14). A solution of **8** (280 mg, 0.55 mmol) in AcOH (3 ml) and 60% $HClO_4$ (0.2 ml) containing Pd-black (120 mg) was stirred at room temperature for 20 h under a hydrogen atmosphere. The reaction mixture was filtered, and the filtrate was neutralized by the addition of sat.aq. $NaHCO_3$, then partitioned between EtOAc and H_2O. The organic layer was washed with brine, dried (Na_2SO_4), and evaporated to give a crude oil (182 mg). To a solution of the oil in MeOH (4 ml) was added 5M KOH solution (0.3 ml); the resulting mixture was stirred at room temperature for 3 h under an argon atmosphere. After being adjusted to pH 5 ~ 6 by the addition of 5M HCl, the mixture was evaporated to dryness. A mixture of the residue and DCC (152 mg) in anhydrous THF (20 ml) was stirred overnight (0 °C → room temperature). The reaction mixture was evaporated, and the residue was purified by a silica gel column (hexane/EtOAc=1:2) to give the corresponding lactone (**14**, 46 mg, 36%) as a yellow solid: IR (nujol) 1640, 1620, and 1560 cm^{-1}; δ_H 3.91 (3H, s), 3.95 (3H, s), 3.99 (2H, d, J= 2 Hz), 6.18 (1H, s), 6.79 (1H, d, J= 2 Hz), 7.77 (1H, br s), and 8.23 (1H, br s); δ_C (DMSO-d_6 + trace HCl) 31.2 (t), 58.0 (q), 60.4 (q), 92.0 (d), 106.8 (s), 112.2 (s), 118.1 (d), 126.8 (s), 127.2 (s), 130.7 (s), 148.0 (s), and 169.1 (s). Calcd for $C_{12}H_{12}N_2O_3$: m/z 232.0846, M^+. Found: 232.0842.

7-{[2-(3,5-Dibromo-4-hydroxyphenyl)ethyl]amino}-1,3,4,8-tetrahydropyrrolo[4,3,2-*de*]quinolin-8-one (15). To a solution of **14** (32 mg, 0.15 mmol) in anhydrous THF (0.5 ml) was added BH_3•SMe_2 (0.04 ml, 0.42 mmol) under an argon atmosphere, and the mixture was stirred at room temperature for 3 h. Essentially the same work up as in the case of **10** provided the crude amine, which was dissolved in 70% aq. MeCN (4 ml). After addition of CAN (240 mg) in 70% aq. MeCN (0.5 ml), the resulting mixture was stirred at room temperature for 5 min. The solvent was removed, and the residue was chromatographed on a silica gel column ($CHCl_3$/MeOH=8:1) to yield the unstable iminoquinone (15 mg, 51%): IR ($CHCl_3$) 1650, 1620, and 1560 cm^{-1}; δ_H 2.84 (2H, t, J= 8 Hz), 3.88 (3H, s), 4.11 (2H, t, J= 8 Hz), 6.09 (1H, s), and 7.02 (1H, s).

The iminoquinone (10 mg, 0.05 mmol) was treated with 3,5-dibromotyramine hydrobromide (76 mg, 0.2 mmol) in EtOH (2.5 ml) containing Na_2CO_3 (42 mg, 0.5 mmol) under the same conditions as in the case of **10**. Chromatographic purification (preparative TLC, $CHCl_3$/MeOH=5:1) provided **15** (17 mg, 74%) as an amorphous solid: IR (nujol) 1665, 1620, 1595, and 1545 cm^{-1}; δ_H 2.90 (2H, t, J= 7.1 Hz), 3.00 (2H, t, J= 7.3 Hz), 3.60 (2H, t, J= 7.1 Hz), 3.90 (2H, t, J= 7.3 Hz), 5.43 (1H, s), 7.20 (1H, s), and 7.42 (1H, s).

Discorhabdin C (1) and 11,13-dibromo-2,3,5,7,8,9-hexahydro-12-hydroxy-6H-pyrrolo[4',3',2':4,5]-quino[8,7-a][3]benzazepin-6-one (16). A solution of **15** (10 mg, 0.02 mmol) in anhydrous MeCN (20 ml) containing $LiClO_4$ (210 mg) was electrolyzed at a constant current (3 mA, 1200 → 1800 mV *vs.* SCE) for 1 h (6 F/mol) under an argon atmosphere. After evaporation of the mixture, the residue was purified by preparative TLC ($CHCl_3$/MeOH/conc NH_4OH=5:1:0.01) to give **1** (2.0 mg, 24%) and **16** (0.5 mg, 6%), along with unreacted **15** (2.2 mg). **1** (amorphous solid): IR (KBr) 1675, 1585, and 1540 cm^{-1}; δ_H (CD_3OD) 2.09 (2H, t, J= 5.6 Hz), 2.83 (2H, t, J= 7.3 Hz), 3.68 (2H, t, J= 5.6 Hz), 3.86 (2H, t, J= 7.3 Hz), 7.13 (1H, s), and 7.74 (2H, s). Calcd for $C_{18}H_{13}N_3O_2{}^{79}Br_2$: m/z 460.9374, M+. Found: 460.9352. **16** (amorphous solid): IR (film) 1660, 1620, 1590, and 1540 cm^{-1}; δ_H (CD_3OD) 2.93 (2H, t, J= 6.8 Hz), 3.00 (2H, t, J= 7.6 Hz), 3.98 (2H, t, J= 7.6 Hz), 4.25 (2H, t, J= 6.8 Hz), 7.19 (1H, s), and 7.39 (2H, s). Calcd for $C_{18}H_{14}N_3O_2{}^{79}Br_2$: m/z 461.9453, (M+H)+. Found: 461.9456.

4,5-Dimethoxy-3-(N-methyl-benzyloxycarbonylamino)benzoic acid (17). A mixture of **5** (36 g, 55 mmol) and NaH (60% dispersion in mineral oil, 33.5 g, 88 mmol) in DMF (80 ml) was stirred at 0 °C for 30 min, and at room temperature for another 30 min. After the addition of MeI (8.0 ml), the stirring was continued for 3 h. The reaction was quenched by the addition of MeOH (3 ml), and the resulting slurry was poured into 300 ml of ice-water, then extracted with ether (300 ml x 2). The ethereal layer was washed with H_2O (300 ml) and brine, dried (Na_2SO_4), and evaporated to dryness. The residue was chromatographed on a silica gel column (hexane/EtOAc=4:1) to give the N-methyl derivative (14.1 g, 77%): IR (film) 1700 and 1585 cm^{-1}; δ_H 3.24 (3H, s), 3.85 (3H, s), 3.94 (3H, s), 5.16 (2H, s), 7.29 (5H, m), 7.32 (1H, d, J= 2 Hz), 7.39 (1H, d, J= 2 Hz), and 9.83 (1H, s).

To an ice-cooled solution of the methyl derivative (12.5 g, 38 mmol) in acetone (150 ml) was added Jones reagent (20 ml), and the mixture was stirred at room temperature for 2 h. The same work up procedure as in the case of **6** provided **17** (11.6 g, 89%): IR (film) 1705 and 1580 cm^{-1}; δ_H 3.24 (3H, s), 3.84 (3H, s), 3.91 (3H, s), 5.16 (2H, s), 7.29 (1H, d, J= 2 Hz, overlapped with 5H signal), 7.61 (1H, d, J= 2 Hz), and 8.65 (1H, br s); δ_C 37.6 (q), 56.2 (q), 60.8 (q), 67.4 (t), 112.9 (d), 123.7 (d), 124.3 (s), 127.8 (d), 127.9 (d), 128.4 (d), 136.6 (s), 150.2 (s), 153.0 (s), 155.7 (s), and 170.5 (s). Calcd for $C_{18}H_{19}NO_6$: m/z 345.1210, M+. Found: 345.1201.

1-Benzyloxycarbonylamino-2,3-dimethoxy-4-(2-trimethylsilylethoxycarbonyl)aminobenzene (18). A mixture of **17** (9.90 g, 29 mmol) and carbonyl diimidazole (5.7 g, 35 mmol) was stirred at room temperature for 1 h, and 5M aq. NaN_3 (30 ml) was added. After 2 h, the resulting mixture was poured into H_2O (300 ml), then extracted with ether (300 ml x 3). The organic layer was washed with H_2O (400 ml), dried (Na_2SO_4), then evaporated. The residue was dissolved in PhMe (80 ml). After being refluxed for 1 h, the solution was cooled to 60 °C, and 2-trimethylsilylethanol (6.7 ml, 45 mmol) was added. The mixture was further stirred at the same temperature for 2 h, then evaporated. The crude product was purified by silica gel column chromatography (hexane/EtOAc=7:3) to give **18** (11.4 g, 86%) as a colorless oil: IR (film) 3350, 1605, 1550, and 1505 cm^{-1}; δ_H 0.09 (9H, s), 0.87 - 1.06 (2H, complex), 3.14 (3H, s), 3.63 (3H, s), 3.79 (3H, s), 4.07 - 4.27 (2H, complex), 5.07 (2H, s), 6.43 (1H, br s), 6.55 (1H, d, J= 3 Hz), 7.12 (1H, d, J= 3 Hz), and 7.22 (5H, complex); δ_C -1.5 (q), 17.8 (t), 37.7 (q), 55.9 (q), 60.7 (q), 63.4 (t), 67.3 (t), 103.1 (d), 110.5 (d), 127.7 (d), 127.8 (d), 128.3 (d), 134.4 (s),

136.4 (s), 136.7 (s), 140.9 (s), 153.4 (s), 153.9 (s), and 155.9 (s). Calcd for $C_{23}H_{32}N_2O_6Si$: m/z 460.2028, M+. Found: 460.2038.

6,7-Dimethoxy-3-ethoxycarbonylmethyl-1-methyl-4-(2-trimethylsilylethoxy)carbonylaminoindole (19). A solution of **18** (4.37 g, 9.5 mmol) in EtOH (40 ml) in the presence of catalytic amounts of 10% Pd-C was stirred at room temperature for 2 h under a hydrogen atmosphere. The reaction mixture was filtered, and the filtrate was evaporated to give the corresponding amine (3.10 g, 100%): IR (film) 3350, 1710, 1610, 1550, and 1525 cm^{-1}; δ_H 0.06 (9H, s), 0.94 - 1.13 (2H, complex), 2.82 (3H, s), 3.75 (3H, s), 3.83 (3H, s), 4.14 - 4.33 (2H, complex), 6.45 (1H, br s), 6.24 (1H, d, J= 2 Hz), and 6.55 (1H, d, J= 2 Hz). Calcd for $C_{23}H_{30}N_2O_4Si$: m/z 326.1615, M+. Found: 326.1609.

A mixture of the amine (2.30 g, 7.1 mmol) and ethyl 4-chloroacetoacetate (5.8 g, 35 mmol) in anhydrous EtOH (40 ml) containing Molecular sieves 3A (5 g) was heated at refluxing temperature for 3 days. The reaction mixture was treated with the same work up procedure as in the case of **8**, followed by chromatographic purification (hexane/acetone=8:1) to give **19** (2.68 g, 87%) as a pale yellow oil: IR (film) 3300, 1720, 1620, 1580, and 1530 cm^{-1}; δ_H 0.06 (9H, s), 1.00 - 1.20 (2H, complex), 1.28 (3H, t, J= 7 Hz), 3.71 (2H, s), 3.88 (3H, s), 3.90 (3H, s), 3.92 (3H, s), 4.10 - 4.30 (2H, complex), 4.35 (2H, q, J= 7 Hz), 6.71 (1H, s), 7.29 (1H, s), and 8.79 (1H, br s); δ_C -1.4 (q), 14.1 (q), 17.8 (t), 32.4 (t), 35.4 (q), 57.1 (q), 61.5 (t), 61.8 (q), 63.1 (t), 102.4 (d), 105.1 (s), 117.2 (s), 126.1 (s), 129.3 (d), 131.5 (s), 132.5 (s), 147.8 (s), 155.2 (s), and 173.9 (s). Calcd for $C_{21}H_{32}N_2O_6Si$: m/z 436.2035, M+. Found: 436.1997.

5-Chloro-2,3-dihydro-6,7-dimethoxy-3-ethoxycarbonylmethyl-1-methyl-4-(2-trimethylsilyl-ethoxy)carbonylaminoindole (20) and 5-chloro-6,7-dimethoxy-3-ethoxycarbonylmethyl-1-methyl-4-(2-tri-methylsilylethoxycarbonyl)aminoindole (21). To an ice-cooled solution of **19** (1.40 g, 3.2 mmol) in AcOH (6 ml) was gradually added $NaBH_3CN$ (482 mg, 7.7 mmol). The mixture was stirred at room temperature for 30 min, and poured into ice-cooled sat.aq. $NaHCO_3$ (50 ml), then extracted with ether (50 ml x 3). The ethereal extracts were washed with H_2O (50 ml) and brine (50 ml), then dried (Na_2SO_4). After evaporation, the residue was chromatographed on a silica gel column (hexane/acetone=4:1) to yield the indoline (1.13 g, 80%): IR (film) 3300, 1725, 1615, 1520, and 1500 cm^{-1}; δ_H 0.06 (9H, s), 1.06 (2H, q, J= 9 Hz), 1.25 (3H, t, J= 7 Hz), 2.56 (1H, dd, J= 17, 6 Hz), 2.65 (1H, dd, J= 17, 7 Hz), 2.95 (3H, s), 3.16 (1H, m), 3.27 (1H, t, J= 9 Hz), 3.49 (1H, m), 3.73 (3H, s), 3.83 (3H, s), 4.16 (2H, q, J= 7 Hz), 4.27 (1H, dt, J= 1, 9 Hz), 7.00 (1H, br s), and 7.43 (1H, br s). Calcd for $C_{21}H_{34}N_2O_6Si$: m/z 438.2185, M+. Found: 438.2200.

To an ice-cooled solution of the indoline (407 mg, 1.0 mmol) in CH_2Cl_2 (10 ml) was gradually added NCS (137 mg, 1.0 mmol). After being reacted at 0 °C for 15 min, the mixture was diluted with CH_2Cl_2 (40 ml), washed with sat.aq. $NaHCO_3$ (20 ml) and brine (20 ml), dried (Na_2SO_4), then evaporated. The residue was purified by silica gel column chromatography (hexane/EtOAc=2:1) to give **20** (303 mg, 69%) coupled with **21** (27 mg, 6%) as a pale yellow oil. **20** (oil): IR (film) 3350, 1725, and 1595 cm^{-1}; δ_H 0.04 (9H, s), 1.04 (2H, t, J= 9 Hz), 1.24 (3H, t, J= 7 Hz), 2.43 (1H, dd, J= 10, 16 Hz), 2.98 (3H, s), 3.29 (1H, m), 3.46 (1H, t, J= 9 Hz), 3.80 - 3.84 (1H, m), 3.82 (3H, s), 3.86 (3H, s), 4.13 (2H, q, J= 7 Hz), 4.25 (2H, dt, J= 2, 9 Hz), and 6.26 (1H, br s); δ_C -1.5 (q), 14.2 (q), 17.6 (t), 37.0 (d), 37.4 (t), 37.7 (q), 60.5 (t), 60.8 (q), 61.1 (q), 62.5 (t), 64.1 (t), 126.0 (s), 126.7 (s), 128.3 (s), 138.3 (s), 144.3 (s), 150.3 (s), 154.4 (s), and 172.3 (s). Calcd for $C_{21}H_{33}{}^{35}ClN_2O_6Si$: m/z 472.1794, M+. Found: 472.1775. **21** (oil): IR (film) 3300, 1725, 1600, and 1500 cm^{-1}; δ_H 0.02 (9H, s), 0.90 - 1.20 (2H, m), 1.27 (3H, t, J= 7 HZ), 3.69 (2H, s), 3.90(3H, s), 3.91 (3H, s), 3.97 (3H, m), 4.10 - 4.35 (2H, m), 4.16 (2H, q, J= 7 Hz), 6.83 (1H, s), and 7.10 (1H, br s); δ_C -1.5 (q), 14.1 (q), 17.7 (t), 31.6 (t), 35.4 (q), 61.0 (t),

61.1 (q), 61.7 (q), 63.7 (t), 106.3 (s), 121.9 (s), 123.4 (s), 128.2 (s), 129.1 (s), 130.8 (d), 139.8 (s), 144.1 (s), 155.4 (s), and 173.2 (s). Calcd for $C_{21}H_{31}{}^{35}ClN_2O_6Si$: m/z 470.1637, M+. Found: 470.1624.

Conversion of 20 to 21. To a solution of **20** (357 mg, 0.76 mmol) in CH_2Cl_2 (4 ml) was gradually added DDQ (176 mg, 0.78 mmol). After 5 min, the mixture was filtered, and the filtrate was concentrated to give a residue, which on chromatographic purification (hexane/EtOAc=2:1) furnished **21** (235 mg, 66%).

6-Chloro-7,8-dimethoxy-1-methyl-1,3,4,5-tetrahydropyrrolo[4,3,2-*de*]quinolin-4-one (22). To a solution of **21** (114 mg, 0.24 mmol) in AcOH (2.0 ml) was added 60% $HClO_4$ (0.1 ml). After being stirred at room temperature for 30 min, the resulting solution was poured into ice cooled 10% aq. $NaHCO_3$, and extracted with EtOAc. The organic layer was washed with brine, dried (Na_2SO_4), then concentrated *in vacuo* to give the amine which was used for the next step without further purification.

A mixture of the product and 5M NaOH (0.1 ml) in MeOH (1.5 ml) was kept at room temperature for 1 h. The pH value of the resulting solution was adjusted to 5 ~ 6 by the addition of 1M HCl, and H_2O (10 ml) was added. The suspension was extracted with $CHCl_3$ (20 ml x 5), and the organic layer was dried (Na_2SO_4), then evaporated to give a dark-green residue. A mixture of the product and DCC (51 mg) in THF (20 ml) was stirred at 0 °C overnight. After removal of the solvent, chromatographic purification (hexane/EtOAc=1:1) provided **22** (39 mg, 58%) as a yellow solid: IR (nujol) 3250, 1665, 1615, and 1515 cm^{-1}; δ_H 3.90 (3H, s), 3.93 (3H, s, overlapped with 2H signal), 3.96 (3H, s), 6.62 (1H, s), and 7.73 (1H, br s); δ_C 33.9 (t), 34.8 (q), 61.5 (q), 62.0 (q), 101.8 (s), 106.1 (s), 113.8 (s), 124.0 (s), 124.1 (d), 125.6 (s), 136.4 (s), 145.2 (s), and 169.1 (s). Calcd for $C_{13}H_{13}{}^{35}ClN_2O_3$: m/z 280.0613, M+. Found: 280.0591.

6-Chloro-7,8-dimethoxy-1-methyl-1,3,4,5-tetrahydropyrrolo[4,3,2-*de*]quinoline (23). To a solution of **22** (18 mg, 0.06 mmol) in THF (1.25 ml) was added BH_3•SMe_2 (0.01 ml). The reaction mixture was stirred at room temperature for 2 h, then H_2O (2 ml) was added. The resulting mixture was extracted with EtOAc (5 ml x 3); the organic extracts were washed with brine, dried (Na_2SO_4), then evaporated. The product was purified by preparative TLC (hexane/EtOAc=2:1) to give **23** (14 mg, 80%) as an amorphous solid: IR (film) 3400, 1620, and 1510 cm^{-1}; δ_H (C_6D_6) 2.69 (2H, t, J= 5.9 Hz), 2.96 (2H, t, J= 5.9 Hz), 3.39 (3H, s), 3.66 (3H, s), 3.88 (3H, s), and 6.03 (1H, s); δ_C (C_6D_6) 23.0 (t), 34.1 (q), 43.2 (t), 61.2 (q), 61.9 (q), 100.3 (s), 109.6 (s), 116.4 (s), 121.6 (d), 127.1 (s), 133.3 (s), 134.3 (s), and 146.3 (s). Calcd for $C_{13}H_{15}{}^{35}ClN_2O_3$: m/z 266.0820, M+. Found: 266.0810.

Batzelline C (2). To an ice-cooled solution of **23** (7.3 mg, 0.026 mmol) in CH_2Cl_2 (1.5 ml) under an argon atmosphere was added 1.0M BBr_3 in CH_2Cl_2 (0.6 ml), and the mixture was gradually warmed to room temperature. After being stirred overnight, 6M HCl (5 ml) was added, and the stirring was continued for 10 min under air. The resulting mixture was poured into sat.aq. $NaHCO_3$ (10 ml), and extracted with $CHCl_3$ (10 ml x 4). The $CHCl_3$ extracts were washed with brine, dried (Na_2SO_4), and evaporated to dryness. The crude product was purified by preparative TLC ($CHCl_3$/MeOH=10:1) to give **2** (4.8 mg, 78%) as a dark brown solid: IR (KBr) 3340, 3065, 1650, 1560, and 1525 cm^{-1}; δ_H (DMSO-d_6) 2.74 (2H, t, J= 7 Hz), 3.58 (2H, br t, J= 7 Hz), 3.83 (3H, s), 7.15 (1H, s), and 8.29 (1H, br s); δ_C (DMSO-d_6) 18.9 (t), 35.5 (q), 41.7 (t), 96.9 (s), 116.7 (s), 122.9 (s), 123.5 (s), 129.4 (d), 148.9 (s), 169.1 (s), and 171.4 (s). Calcd for $C_{11}H_9{}^{37}ClN_2O_2$: m/z 238.0322, M+. Found: 238.0313.

Isobatzelline C (3). To a stirred solution of **23** (9 mg, 0.035 mmol) in 70% aq. acetone (2 ml) was added CAN (57 mg) in acetone (0.5 ml). After 5 min, the mixture was concentrated to a 1 ml volume, then H_2O (2 ml)

was added. After extraction with $CHCl_3$ (3 ml x 4), the organic layer was washed with brine, dried (Na_2SO_4), then evaporated. Purification of the product by preparative TLC ($CHCl_3$/MeOH=10/1) provided the corresponding iminoquinone (5.2 mg, 64%) as a dark green solid: IR (film) 1640, 1610, 1560, and 1540 cm^{-1}; δ_H (CD_3OD) 2.74 (2H, t, J= 8 Hz), 3.92 (3H, s), 4.03 (3H, s), 4.24 (2H, t, J= 8 Hz), and 6.63 (1H, s).

A mixture of the iminoquinone (3.5 mg, 0.014 mmol) and NH_4Cl (50 mg) in EtOH (1 ml) under an argon atmosphere was stirred at room temperature for 14 h. The reaction mixture was filtered, and the filtrate was evaporated to give a residue, which on chromatographic purification ($CHCl_3$/MeOH=4:1) provided **3** (2.1 mg, 64%): IR (KBr) 3360, 3050, 1650, and 1595 cm^{-1}; δ_H (CD_3OD) 2.86 (2H, t, J= 8 Hz), 3.99 (2H, t, J= 8 Hz), 3.97 (3H, s), and 7.04 (1H, s); δ_C (DMSO-d_6 + trace HCl) 18.0 (t), 36.0 (q), 43.0 (t), 92.1 (s), 118.7 (s), 121.5 (s), 122.6 (s), 131.5 (d), 152.2 (s), 152.7 (s), and 165.9 (s). Calcd for $C_{11}H_{10}{}^{35}ClN_3O$: m/z 235.0511, M+. Found: 235.0496

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