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REACTIONS OF 2-(LITHIOMETHYL)PHENYL ISOCYANIDES WITH METHYL 1-METHYLINDOLE-3-CARBOXYLATE: ELABORATIONS OF THE ADDUCTS TO 5*H*-BENZ[2,3]AZEPINO[5,6-*c*]INDOL-12-ONE AND 2,3'-BIINDOLYL DERIVATIVES

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Abstract – It has been found that when 2-(lithiomethyl)phenyl isocyanides were allowed to react with methyl 1-methylindole-3-carboxylate, the corresponding 1,4- and/or 1,2-adducts were obtained. The 1,4-adducts could be transformed into 6,11-dihydro-5*H*-benz[2,3]azepino[5,6-*b*]indol-12-ones derivatives by acid hydrolysis, followed by lactamization and subsequent dehydrogenation. The transformation of the 1,2-adducts into 2,3'-biindolyls was accomplished by a sequential treatment with hydrochloric acid and aqueous sodium hydroxide.

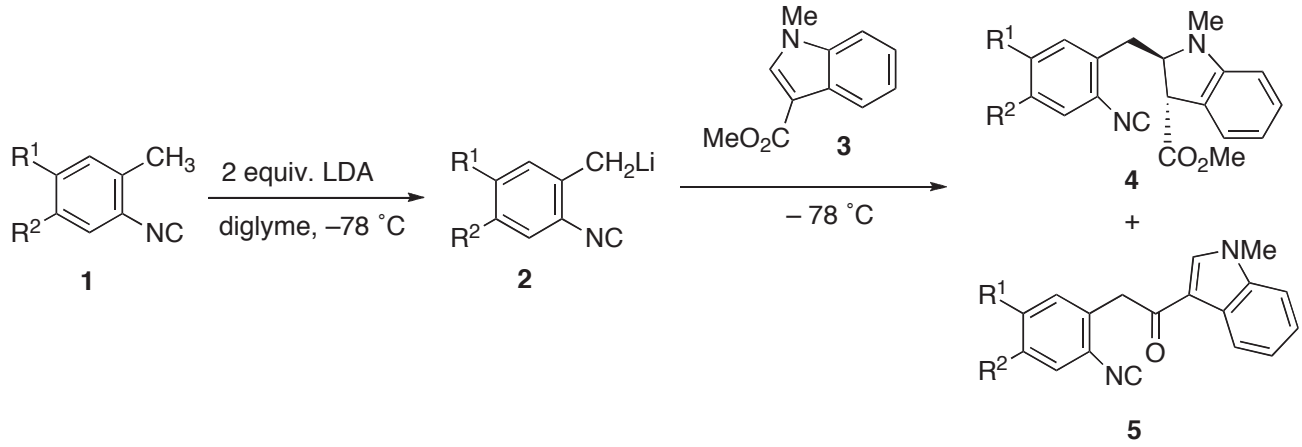
INTRODUCTION

We wish to report here on reactions of 2-(lithiomethyl)phenyl isocyanides (**2**) with methyl 1-methylindole-3-carboxylate (**3**), which afforded the 1,4-adducts (**4**) and/or 1,2-adducts (**5**). This is the first case in which organolithiums add intermolecularly to the 2-position of indole-3-carboxylates in a conjugate addition fashion, though intramolecular conjugate addition of α-lithioaziridines to indole-3-carboxylates has been reported by Vedejs et al.[1] The former adducts could be transformed into 6,11-dihydro-5*H*-benz[2,3]azepino[5,6-*b*]indol-12-ones (**8**) by hydrolysis with hydrochloric acid followed by lactamization of the resulting amino ester derivatives and subsequent dehydrogenation. To the best of our knowledge, there have been no reports for the construction of this indolobenzazepinone structure so far. 2,3'-Biindolyls (**10**) could be obtained from the latter adducts on treatment with hydrochloric acid followed by alkalization with sodium hydroxide. Molecules having the 2,3'-biindolyl skeleton may be of interest from a biological point of view. Moreover, 2,3'-biindolyls have been utilized as precursors for the

synthesis of more complex and useful heterocycles.[2] There has been, however, little work[3] on the method for preparing this group of biindolyls, particularly those having substituents which may have considerable potential in organic synthesis.

RESULTS AND DISCUSSION

2-(Lithiomethyl)phenyl isocyanides (**2**) could be readily generated from the respective 2-methylphenyl isocyanides (**1**) by the procedure reported by Ito et al.[4] The reaction of **2** with methyl 1-methylindole-3-carboxylate (**3**) afforded the 1,4-adducts, methyl *trans*-2-(2-isocyanobenzyl)-1-methylindoline-3-carboxylates (**4**), and/or 1,2-adducts, 2-isocyanobenzyl 1-methylindol-3-yl ketones (**5**), as shown in Scheme 1. The ratios of the products (**4**) and (**5**) depend upon the substituent other than lithiomethyl and isocyano groups on the benzene ring of **1**, as summarized in Table 1. In the case of using (2-lithiomethyl)phenyl isocyanide (**2a**) and 2-lithiomethyl-4-methoxyphenyl isocyanide (**2d**) the corresponding 1,4-adducts were produced predominantly (Entries 1 and 4). 2-Lithiomethyl-5-methylphenyl isocyanide (**2b**) gave the corresponding 1,4-adduct exclusively (Entry 2), while 5-chloro-2-(lithiomethyl)phenyl isocyanide (**2c**) gave the corresponding 1,2-adducts predominantly (Entry 3). One of the two possible diastereoisomers of each of the 1,4-adducts (**4**) was obtained. We tentatively determined the stereochemistry to be *trans* due to its thermodynamical stability.



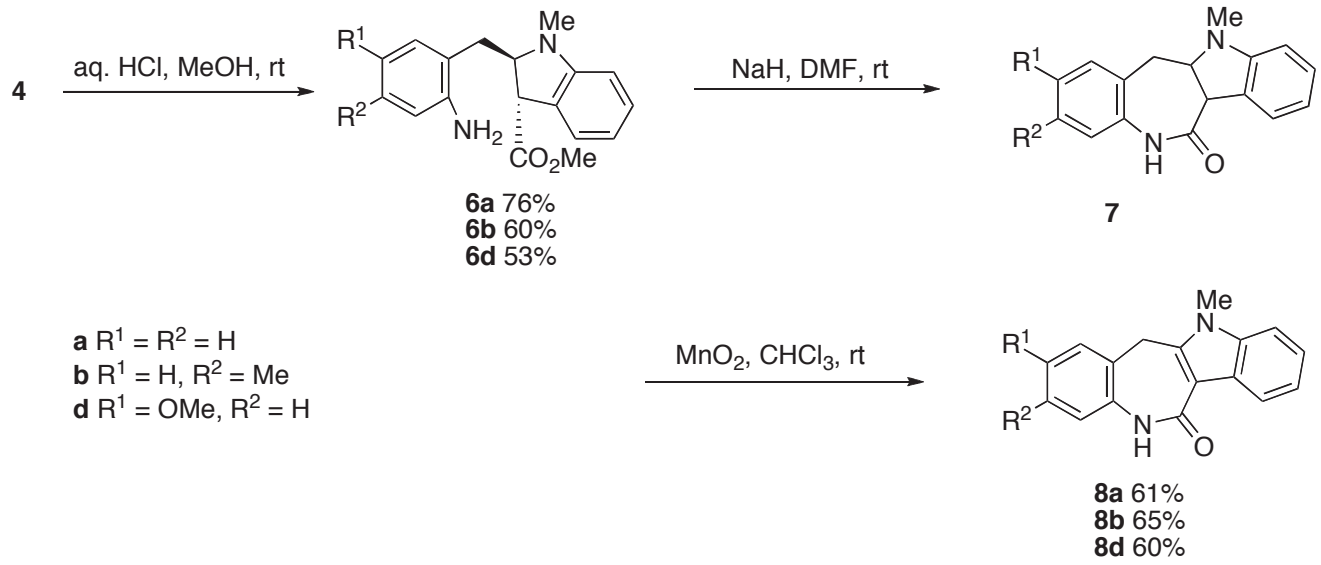
Scheme 1

Table 1. Products from the Reaction of Isocyanides (**1**) with Methyl 1-Methylindole-3-carboxylate (**3**)

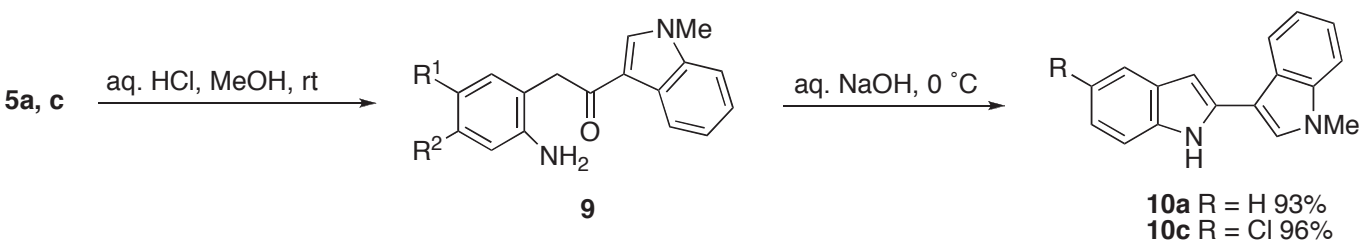
Entry	**1**	**4** (Yield/%)[a]	**5** (Yield/%)[a]
1	**1a** ($R^1 = R^2 = H$)	**4a** (65)	**5a** (25)
2	**1b** ($R^1 = H$, $R^2 = Me$)	**4b** (78)	**5b** (0)
3	**1c** ($R^1 = Cl$, $R^2 = H$)	**4c** (8)	**5c** (68)
4	**1d** ($R^1 = OMe$, $R^2 = H$)	**4d** (75)	**5d** (6)

[a]Isolated yields.

With these results in hand, we then turned attention to elaborations of these adducts. First, the conversion of methyl *trans*-2-(2-isocyanobenzyl)-1-methylindoline-3-carboxylates (**4**) into 5-methyl-6,11-dihydro-5*H*-benz[2,3]azepino[5,6-*b*]indol-12-ones (**8**) was performed as illustrated in Scheme 2. Thus, the isocyano moiety of **3** was hydrolyzed with hydrochloric acid in methanol to the amino moiety. The reaction proceeded smoothly at room temperature, the desired methyl *trans*-2-(2-aminobenzyl)-1-methylindoline-3-carboxylates (**6**) being isolated in fair-to-good yields after workup followed by purification by preparative TLC. After some trials to find a satisfactory method for the transformation of these amino eaters (**6**) into 5a,6,11,12a-tetrahydro-5*H*-benz[2,3]azepino[5,6-*b*]indol-12-ones (**7**), lactamization was carried out in DMF in the presence of sodium hydride at room temperature. The reaction was completed within 20 min, and the desired lactams (**7**) were obtained after the usual workup. However, these lactams proved to be rather labile to air, so these are subjected to dehydrogenation with activated manganese(IV) oxide in chloroform at room temperature without any purification. The reaction proceeded smoothly, and the corresponding desired dihydrobenzazepinoindolone (**8**) were obtained in satisfactory over yields from **6** by simply filtering off the oxidant, evaporating the solvent, and recrystalizing the residual solids.



Scheme 2



Scheme 3

The transformation of 2-isocyanobenzyl 1-methylindol-3-yl ketones (**5**) into 2,3'-biindolyls (**10**) were accomplished as outlined in Scheme 3. Thus, hydrolysis of **5** with hydrochloric acid in methanol and subsequent condensation of the resulting hydrochlorides of 2-aminobenzyl 1-methylindol-3-yl ketones (**9**) by making alkaline with aqueous sodium hydroxide afforded **10** in excellent yields.

In conclusion, the results mentioned above demonstrate that the reactions of 2-(lithiomethyl)phenyl isocyanides with methyl 1-methylindole-3-carboxylate offers synthetic routes to 6,11-dihydro-5*H*-benz[2,3]azepino[5,6-*b*]indol-12-ones and 2,3'-biindoles. The sequences described in this paper may be useful for the preparation of the former previously unknown derivatives and the latter potential useful derivatives, which are hard to prepare by conventional methods.

EXPERIMENTAL

All melting points were obtained on a Laboratory Devices MEL-TEMP II melting apparatus and are uncorrected. IR spectra were determined with a Shimadzu FTIR-8300 spectrophotometer. The ^{1}H NMR spectra were determined in $CDCl_3$ using TMS as an internal reference with a JEOL ECP500 FT NMR spectrometer operating at 500 MHz or a JEOL LA400 FT NMR spectrometer operating at 400 MHz. The ^{13}C NMR spectra were determined in $CDCl_3$ using TMS as an internal reference with a JEOL ECP500 FT NMR spectrometer operating at 125 MHz or a JEOL LA400 FT NMR spectrometer operating at 100 MHz. Low-resolution MS spectra (EI, 70 eV) were measured by a JEOL JMS AX505 HA spectrometer. TLC was carried out on a Merck Kieselgel 60 PF_{254}. Column chromatography was performed using Merck Kieselgel 60 (0.063–0.200 mm). All of the organic solvents used in this study were dried over appropriate drying agents and distilled prior to use.

Starting Materials. 1-Isocyano-2-methylbenzenes (**1**)[4b] and methyl 1-methylindole-3-carboxylate (**3**)[5] were prepared according to the appropriate reported procedures. All other chemicals used in this study were commercially available.

General Procedure for the Reaction of 2-(Lithiomethy)phenyl Isocyanides (2) with Methyl Indole-3-carboxylate (3). Methyl *trans*-2-[(2-Isocyanophenyl)methyl]-1-methyl-2,3-dihydroindole-3-carboxylate (4a) and [(2-Isocyanophenyl)methyl](1-methylindol-3-yl)methanone (5a). To a stirred deep-red solution of 1-isocyano-2-(lithiomethyl)benzene (**2a**) (3.0 mmol), generated from 1-isocyano-2- methylbenzene (**1a**) by treating with 2 molar amounts of LDA according to the previously reported procedure,[1] in diglyme (8 mL) at –78 °C was added a solution of methyl 1-methylindole-3-carboxylate (**3**) (1.1 g, 6.0 mmol) in diglyme (7 mL); the red color of the anion faded gradually. After 15 min, Et_2O (30 mL), aqueous saturated NH_4Cl (5 mL), and water (25 mL) were added, and the mixture was allowed to warm to room temperature. The precipitate was collected by filtration and the filtrate was separated. The aqueous layer was extracted with Et_2O three times (10 mL each). The combined extracts were washed with water five times and then brine once, and dried over anhydrous

Na_2SO_4. After evaporation of the solvent, the residue was purified by column chromatography on silica gel to give **4a** (0.37 g, 65%); a yellow oil; R_f 0.28 (1:2 Et_2O–hexane); IR (neat) 2120, 1738 cm^{-1}; ^1H NMR (400 MHz) δ 2.87 (s, 3H), 2.95 (dd, *J* = 13.6, 8.2 Hz, 1H), 3.45 (dd, *J* = 13.6, 4.4 Hz, 1H), 3.56 (s, 3H), 3.83 (d, *J* = 9.2 Hz, 1H), 4.16 (ddd, *J* = 9.2, 8.2, 4.4 Hz, 1H), 6.52 (d, *J* = 7.7 Hz, 1H), 6.99 (dd, *J* = 7.7, 6.9 Hz, 1H), 7.12–7.17 (m, 2H), 7.27 (dd, *J* = 7.7, 6.9 Hz, 1H), 7.31–7.34 (m, 2H), 7.39 (d, *J* = 7.7 Hz, 1H); ^{13}C NMR (125 MHz) δ 34.80, 35.43, 51.58, 52.14, 68.45, 108.04, 118.32, 124.06, 125.31, 127.09, 127.73, 128.93, 129.30, 131.28 (2C), 134.18 (2C), 152.33, 171.63; MS *m/z* 306 (M^+, 13), 190 (100). Anal. Calcd for $C_{19}H_{18}N_2O_2$: C, 74.49; H, 5.92; N, 9.14. Found: C, 74.45; H, 6.13; N, 8.86. The precipitate obtained by filtration was recrystallized from $CHCl_3$–THF to give **5a** (0.21 g, 25%); a white solid; mp 204–206 °C; IR (KBr) 2122, 1630 cm^{-1}; ^1H NMR (500 MHz) δ 3.88 (s, 3H), 4.32 (s, 2H), 7.28–7.39 (m, 6H), 7.40 (d, *J* = 7.8 Hz, 1H), 7.94 (s, 1H), 8.38 (dd, *J* = 7.8, 1.4 Hz, 1H); ^{13}C NMR (125 MHz) δ 33.63, 42.28, 109.67, 116.15, 122.67, 122.87, 123.65, 126.51, 126.82, 127.77, 129.46, 131.27, 132.58, 135.97 (2C), 137.61, 166.29, 189.96; MS *m/z* 274 (M^+, 8.5), 158 (100). Anal. Calcd for $C_{18}H_{14}N_2O$: C, 78.81; H, 5.14; N, 10.21. Found: C, 78.78; H, 5.30; N, 10.06.

Methyl *trans*-2-[(2-Isocyano-4-methylphenyl)methyl]-1-methyl-2,3-dihydroindole-3-carboxylate (4b): a yellow oil; R_f 0.38 (1:5 AcOEt–hexane); IR (neat) 2120, 1740, 1605 cm^{-1}; ^1H NMR (400 MHz) δ 2.32 (s, 3H), 2.87 (s, 3H), 2.91 (dd, *J* = 13.6, 8.2 Hz, 1H), 3.39 (dd, *J* = 13.6, 5.3 Hz, 1H), 3.58 (s, 3H), 3.82 (d, *J* = 9.3 Hz, 1H), 4.13 (ddd, *J* = 9.3, 8.2, 5.3 Hz, 1H), 6.51 (d, *J* = 7.3 Hz, 1H), 6.68 (t, *J* = 7.3 Hz, 1H), 7.08–7.20 (m, 5H). Anal. Calcd for $C_{20}H_{20}N_2O_2$: C, 74.98; H, 6.29; N, 8.74. Found: C, 74.82; H, 6.31; N, 8.71.

Methyl *trans*-2-[(5-Chloro-2-isocyanophenyl)methyl]-1-methyl-2,3-dihydroindole-3-carboxylate (4c): a yellow oil; R_f 0.30 (1:3 Et_2O–hexane); IR (neat) 2120, 1734, 1605 cm^{-1}; ^1H NMR (400 MHz) δ 2.87 (s, 3H), 2.93 (dd, *J* = 13.6, 7.8 Hz, 1H), 3.41 (dd, *J* = 13.6, 4.9 Hz, 1H), 3.63 (s, 3H), 3.82 (d, *J* = 9.3 Hz, 1H), 4.12 (ddd, *J* = 9.3, 7.8, 4.9 Hz, 1H), 6.53 (d, *J* = 7.8 Hz, 1H), 6.71 (dd, *J* = 7.8, 7.3 Hz, 1H), 7.13–7.17 (m, 2H), 7.25 (dd, *J* = 8.3, 2.4 Hz, 1H), 7.31–7.34 (m, 2H). Anal. Calcd for $C_{19}H_{17}ClN_2O_2$: C, 66.96; H, 5.03; N, 8.22. Found: C, 66.81; H, 5.11; N, 8.16.

[(5-Chloro-2-isocyanophenyl)methyl](1-methylindol-3-yl)methanone (5c): a white solid; mp 225–228 °C (hexane–$CHCl_3$); IR (KBr) 2120, 1636 cm^{-1}; ^1H NMR (400 MHz) δ 3.89 (s, 3H), 4.28 (s, 2H), 7.27–7.38 (m, 5H), 7.50 (d, *J* = 2.0 Hz, 1H), 7.92 (s, 1H), 8.37 (dd, *J* = 6.3, 1.9 Hz, 1H). Anal. Calcd for $C_{18}H_{13}ClN_2O$: C, 70.02; H, 4.24; N, 9.07. Found: C, 69.75; H, 4.23; N, 8.95.

Methyl *trans*-2-[(2-Isocyano-5-methoxyphenyl)methyl]-1-methyl-2,3-dihydroindole-3-carboxylate (4d): a yellow oil; R_f 0.63 (1:1 Et_2O–hexane); IR (neat) 2118, 1738, 1607 cm^{-1}; ^1H NMR (500 MHz) δ 2.87 (s, 3H), 2.90 (dd, *J* = 13.8, 8.2 Hz, 1H), 3.41 (dd, *J* = 13.8, 4.6 Hz, 1H), 3.59 (s, 3H), 3.81 (s, 3H), 3.85 (d, *J* = 9.8 Hz, 1H), 4.15 (ddd, *J* = 9.8, 8.2, 4.6 Hz, 1H), 6.52 (d, *J* = 7.8 Hz, 1H), 6.69 (ddd, *J* = 7.8, 7.3, 0.9 Hz, 1H), 6.76 (dd, *J* = 8.7, 2.7 Hz, 1H), 6.81 (dd, *J* = 2.7 Hz, 1H), 7.12–7.16 (m, 2H), 7.32 (d, *J* =

8.7 Hz, 1H); MS *m/z* 336 (M^+, 14), 190 (100). Anal. Calcd for $C_{20}H_{20}N_2O_3$: C, 71.41; H, 5.99; N, 8.33. Found: C, 71.55; H, 6.00; N, 8.28.

2-Isocyano-5-methoxyphenylmethyl(1-methylindol-3-yl)methanone (5d): a white solid; mp 204–206 °C (hexane– Et_2O); IR (KBr) 2119, 1631, 1611 cm^{-1}; ^1H NMR (500 MHz) δ 3.81 (s, 3H), 3.88 (s, 3H), 4.26 (s, 2H), 6.79 (dd, *J* = 8.7, 2.7 Hz, 1H), 7.01 (d, *J* = 2.7 Hz, 1H), 7.29–7.37 (m, 4H), 7.94 (s, 1H), 8.39 (dd, *J* = 6.9, 1.4 Hz, 1H). Anal. Calcd for $C_{19}H_{16}N_2O_2$: C, 74.98; H, 5.30; N, 9.20. Found: C, 74.98; H, 5.37; N, 9.07.

General Procedure for the Preparation of 2-(2-Aminobenzyl)indoline-3-carboxylates (6). Methyl *trans*-2-[(2-Aminophenyl)methyl]-1-methyl-2,3-dihydroindole-3-carboxylate (6a). To a stirred solution of **4a** (0.19 g, 0.62 mmol) in MeOH at rt was added 10% aqueous HCl (0.5 mL). The mixture was stirred for 30 min at the same temperature, and then it was made alkaline by adding 10% aqueous NaOH and extracted with Et_2O three time (10 mL each). The combined extracts were washed with brine and dried over anhydrous Na_2SO_4. Evaporation of the solvent gave a residue, which was purified by preparative TLC on silica gel to give **6a** (0.14 g, 76%); a pale yellow solid; mp 113–116 °C (hexane–Et_2O); IR (KBr) 3445, 3370, 1736, 1624, 1605 cm^{-1}; ^1H NMR (500 MHz) δ 2.76 (s, 3H), 3.01 (d, *J* = 6.0 Hz, 2H), 3.65 (s, 3H), 3.79 (d, *J* = 10.1 Hz, 1H), 4.02 (dt, *J* = 10.1, 6.0 Hz, 1H), 4.04 (br s, 2H), 6.54 (d, *J* = 7.8 Hz, 1H), 6.66 (dd, *J* = 7.8, 0.9 Hz, 1H), 6.71 (td, *J* = 7.3, 0.9 Hz, 1H), 6.72 (td, *J* = 7.3, 0.9 Hz, 1H), 7.04 (ddd, *J* = 7.8, 7.3, 1.4 Hz, 1H), 7.07 (dd, *J* = 7.3, 1.4 Hz, 1H), 7.14 (dd, *J* = 7.8, 7.3 Hz, 1H), 7.22 (d, *J* = 7.3 Hz, 1H); MS *m/z* 296 (M^+, 14), 190 (100). Anal. Calcd for $C_{18}H_{20}N_2O_2$: C, 72.95; H, 6.80; N, 9.45. Found: C, 72.81; H, 6.85; N, 9.50.

Methyl *trans*-2-[(2-Amino-4-methylphenyl)methyl]-1-methyl-2,3-dihydroindole-3-carboxylate (6b): a yellow oil; R_f 0.48 (1:2 AcOEt–hexane); IR (neat) 3460, 3379, 1732, 1630 cm^{-1}; ^1H NMR (400 MHz) δ 2.23 (s, 3H), 2.76 (s, 3H), 2.97 (d, *J* = 5.9 Hz, 2H), 3.72 (s, 3H), 3.85 (d, *J* = 9.6 Hz, 1H), 3.97 (br s, 2H), 4.00 (dt, *J* = 9.6, 5.9 Hz, 1H), 6.49–6.54 (m, 3H), 6.72 (td, *J* = 7.3, 1.0 Hz, 1H), 6.95 (d, *J* = 7.8 Hz, 1H), 7.14 (ddd, *J* = 7.8, 7.3, 1.0 Hz, 1H), 7.21 (d, *J* = 7.3 Hz, 1H); ^{13}C NMR (100 MHz) δ 21.05, 35.01, 35.97, 51.10, 52.23, 68.98, 108.63, 116.75, 118.66, 119.45, 119.68, 124.50, 125.66, 128.67, 131.65, 137.54, 145.18, 152.66, 172.32. Anal. Calcd for $C_{19}H_{22}N_2O_2$: C, 73.52; H, 7.14; N, 9.03. Found: C, 73.45; H, 7.12; N, 9.02.

Methyl *trans*-2-[(2-Amino-5-methoxylphenyl)methyl]-1-methyl-2,3-dihydroindole-3-carboxylate (6d): a yellow solid; mp 80–82 °C (hexane–AcOEt); IR (KBr) 3426, 3364, 1732, 1605 cm^{-1}; ^1H NMR (500 MHz) δ 2.76 (s, 3H), 2.99 (d, *J* = 6.0 Hz, 2H), 3.73 (s, 3H), 3.74 (s, 3H), 3.76 (br s, 2H), 3.87 (d, *J* = 9.6 Hz, 1H), 4.02 (dt, *J* = 9.6, 6.0 Hz, 1H), 6.53 (d, *J* = 7.8 Hz, 1H), 6.62 (d, *J* = 8.2 Hz, 1H), 6.65 (dd, *J* = 8.2, 2.7 Hz, 1H), 6.68 (d, *J* = 2.7 Hz, 1H), 6.72 (dd, *J* = 7.8, 7.3 Hz, 1H), 7.15 (dd, *J* = 7.8, 7.3 Hz, 1H), 7.21 (d, *J* = 7.8 Hz, 1H). Anal. Calcd for $C_{19}H_{22}N_2O_3$: C, 69.92; H, 6.79; N, 8.58. Found: C, 69.76; H, 7.02; N, 8.53.

General Procedure for the Preparation of Benzazepinoindolones (8). 5-Methyl-6,11-dihydro-5*H*-benz[2,3]azepino[5,6-*c*]indol-12-one (8a). To a suspension of NaH (60% in oil; 16 mg, 0.39 mmol) in DMF (3 mL) at rt was added a solution of **6a** (0.12 g, 0.39 mmol) in DMF (2 mL); the mixture was stirred for 20 min at the same temperature. Aqueous saturated NH_4Cl (15 mL) and water (15 mL) were added, and organic materials were extracted with AcOEt three times (10 mL each). The combined extracts were washed with water three times and dried over anhydrous Na_2SO_4. Evaporation of the solvent gave a crude 5-methyl-5a,6,11,12a-tetrahydro-5*H*-benz[2,3]azepino[5,6-*c*]indol-12-one (**7a**) (0.10 g). Since this compound was air-sensitive, it was used in the next dehydration step without purification. Thus, the crude **7a** was dissolved in $CHCl_3$ (5 mL) and MnO_2 (0.34 g, 3.9 mmol) was added; the mixture was stirred at room temperature for 1 h. The resulting mixture was filtered by suction, and the filtrate was evaporated to give a residual solid, which was recrystallized from hexane–THF to give **8a** (61 mg, 61%); a light brown solid; mp 236–240 °C; IR (KBr) 3288, 1647 cm^{-1}; ^1H NMR (500 MHz) δ 3.88 (s, 3H), 4.15 (s, 2H), 7.04 (d, *J* = 7.3 Hz, 1H), 7.11 (ddd, *J* = 7.8, 7.3, 1.4 Hz, 1H), 7.22–7.33 (m, 4H), 7.32 (dd, *J* = 6.9, 1.8 Hz, 1H), 7.55 (br s, 1H), 8.22 (dd, *J* = 6.9, 1.8 Hz, 1H); ^{13}C NMR (100 MHz) δ 29.84, 30.17, 109.42 (2C), 121.08, 121.19, 122.05, 122.64, 124.70, 126.83, 127.98, 128.31, 128.93, 136.90, 138.09, 138.21, 164.75; MS *m/z* 262 (M^+, 100). Anal. Calcd for $C_{17}H_{14}N_2O$: C, 77.84; H, 5.38; N, 10.68. Found: C, 77.91; H, 5.41; N, 10.39.

5,9-Dimethyl-6,11-dihydro-5*H*-benz[2,3]azepino[5,6-*c*]indol-12-one (8b): a pale-yellow solid; mp 220–222 °C (hexane–THF); IR (KBr) 3198, 1647 cm^{-1}; ^1H NMR (400 MHz) δ 2.30 (s, 3H), 3.84 (s, 3H), 4.09 (s, 2H), 6.86 (s, 1H), 6.90 (d, *J* = 8.1 Hz, 1H), 7.11 (d, *J* = 7.7 Hz, 1H), 7.21–7.30 (m, 3H), 7.68 (br s, 1H), 8.21 (dd, *J* = 6.9, 2.2 Hz, 1H) ; ^{13}C NMR (125 MHz) δ 20.88, 29.76, 29.81, 105.74, 109.37, 121.09, 121.66, 122.00, 122.57, 125.33, 125.44, 126.89, 128.00, 129.56, 137.83, 137.99, 143.61, 166.62. Anal. Calcd for $C_{18}H_{16}N_2O$: C, 78.24; H, 5.84; N, 10.14. Found: C, 78.12; H, 5.82; N, 10.08.

8-Methoxy-5-methyl-6,11-dihydro-5*H*-benz[2,3]azepino[5,6-*c*]indol-12-one (8d): a pale-yellow solid; mp 251–255 °C (hexane–THF); IR (KBr) 3278, 1640 cm^{-1}; ^1H NMR (500 MHz) δ 3.79 (s, 3H), 3.85 (s, 3H), 4.10 (s, 2H), 6.76 (dd, *J* = 8.2, 2.7 Hz, 1H), 6.78 (d, *J* = 2.7 Hz, 1H), 7.01 (d, *J* = 8.2 Hz, 1H), 7.22–7.27 (m, 2H), 7.30 (dd, *J* = 6.9, 2.3 Hz, 1H), 7.81 (br s, 1H), 8.21 (dd, *J* = 6.9, 2.3 Hz, 1H); MS *m/z* 292 (M^+, 100). Anal. Calcd for $C_{14}H_{16}N_2O$: C, 73.95; H, 5.52; N, 9.58. Found: C, 74.00; H, 5.42; N, 9.43.

General Procedure for the Preparation of 2,3'-Biindolyls (10). 1'-Methyl-2,3'-biindolyl (10a). To a stirred suspension of **5a** (95 mg, 0.35 mmol) in MeOH (3 ml) at 0 °C was added 10% aqueous HCl (0.5 mL) and stirring was continued at rt for 1.5 h. Then the mixture was made alkaline (pH 9) by adding 10% aqueous NaOH at 0 °C, and organic materials extracted with AcOEt three times (10 mL each). The combined extracts were washed with brine, dried over anhydrous Na_2SO_4, and evaporated. The residue was purified by preparative TLC on silica gel (1:2 THF–hexane) to give **10a** (80 mg, 93%); a slightly purplish solid; mp 141–144 °C (hexane–Et_2O) (lit.,[3b] 142–144 °C). The spectral (IR, ^1H NMR, and ^{13}C

NMR) data of this product was identical to those reported previously.[3b]

5-Chloro-1'-methyl-2,3'-biindolyl (10c): a slightly purplish solid; mp 151–153 ˚C (hexane–Et_2O); IR (KBr) 3414, 3050, 1618 cm^{-1}; ^1H NMR (400 MHz) δ 3.86 (s, 3H), 6.67 (d, *J* = 1.5 Hz, 1H), 7.09 (dd, *J* = 8.7, 1.8 Hz, 1H), 7.26 (t, *J* = 7.7 Hz, 1H), 7.27 (d, *J* = 8.7 Hz, 1H), 7.30 (s, 1H), 7.31 (t, *J* = 7.7 Hz, 1H), 7.39 (d, *J* = 7.7 Hz, 1H), 7.57 (d, *J* = 1.8 Hz, 1H), 7.95 (d, *J* = 7.7 Hz, 1H), 8.21 (br s, 1H); ^{13}C NMR (125 MHz) δ 32.94, 98.41, 108.02, 109.79, 111.26, 119.13, 119.84, 120.48, 121.31, 122.57, 125.45, 125.64, 126.24, 130.70, 134.36, 135.03, 137.31. Anal. Calcd for $C_{17}H_{13}ClN_2$: C, 72.73; H, 4.67; N, 9.98. Found: C, 72.50; H, 4.83; N, 9.91.

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