N- and *O*-Alkylation of 3-indolylcyclopropylacetic acid derivatives

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2,2-Dimethyl-3-(2-methyl-3-indolyl)cyclopropylacetic acid, its amide and esters, and the corresponding alcohol, *viz.*, the product of ester reduction by $LiAlH_4$, were synthesized. The chemoselectivity of *N*- and *O*-alkylation of these compounds was studied. Selective monoalkylation at the nitrogen atom of the heterocycle, *O*-alkylation to the side chain, or dialkylation at both nucleophilic sites can be carried out under conditions of phase-transfer catalysis. The *N*-acylation at the indole fragment of nitrile of this acid occurs only under the Vilsmeier—Haak formylation conditions.

Key words: Fischer indole synthesis; 3-indolylcyclopropylacetic acid and its esters, nitriles, amides; hydrolysis; *N*-alkylation and *N*-sulfonylation of indoles; *O*-alkylation of carboxylic acids and alcohols; phase-transfer catalysis; Vilsmeier—Haak reaction.

N-Alkylation and *N*-acylation of indoles are the main methods for the synthesis of 1-substituted indole derivatives and are often used in syntheses of various biologically active compounds, for example, alkaloids.[1,2] Although the development of methods of indole alkylation produced new alkylating systems,[3—5] alkylation under the phase-transfer catalysis conditions by quaternary ammonium salts and crown ethers found the most acceptance.[6—8] This method makes it possible to retain other reactive functional groups in the molecule and avoid the formation of products of C(3)-alkylation of the heterocycle. It is known that 2- and 3-alkyl substituents, being simultaneously present in the heterocycle ring, decrease the reactivity of indoles with respect to their unsubstituted and monosubstituted analogs[8—10] and, in some cases, result in the formation of 3-alkylated 3*H*-indole only.[11,12]

The purpose of this work is to study the chemoselectivity of *N*-alkylation of 2,3-dialkylindoles under the phase-transfer catalysis conditions, using 3-indolylcyclopropylacetic acid and its derivatives in the presence of other competitive functional groups (—COOH, —COOR, $—CONH_2$, and —OH) as an example.

Results and Discussion

As model compounds for studying the competitive *N*- and *O*-alkylation reactions (Scheme 1) 2,3-disubstituted indoles **2** and **4—7** were synthesized. The common precursor of the indoles is monoterpene ketone **1** obtained from (+)-3-carene.[13] The side chain of the heterocycle of these compounds contains functional groups that can undergo alkylation simultaneously with the indole ring or enter into other transformations under the alkylation conditions. Compounds **4—7** were obtained as follows. Nitrile **2**, which was synthesized from ketone **1** by the Fischer indole reaction,[14] was treated with an alkaline solution of H_2O_2 to transform into the corresponding amide **5** in 68% yield. However, we failed to completely hydrolyze nitrile **2** to the acid or transform it into the ester by the Pinner reaction: the products obtained did not contain the cyclopropane fragment in the molecule (^{1}H NMR spectroscopic data). Therefore, ester **4** was synthesized from ω-keto ester **3** obtained from nitrile **1**.[15] Ester **4** can readily be transformed into acid **6** or alcohol **7** by mild alkaline hydrolysis or reduction with $LiAlH_4$, respectively.

Using indole **2** as an example, we demonstrated the efficiency of an alkyl halide—50% NaOH—TEBAC system for the synthesis of the corresponding *N*-alkyl derivatives, but no 3-alkylation products were found (Scheme 2). In the case of allyl bromide, the reaction occurred in a low yield (~10%). Therefore, the anhydrous system alkyl halide—Bu^{t}OK—18-crown-6 was used for the synthesis of *N*-allylindole **12**, and the yield of the product was 72%. *N*-Methylindole **8** is formed virtually similarly in both systems in 77% yield. However, the reaction duration is 2—4-fold longer when alkylation is performed under the anhydrous conditions.

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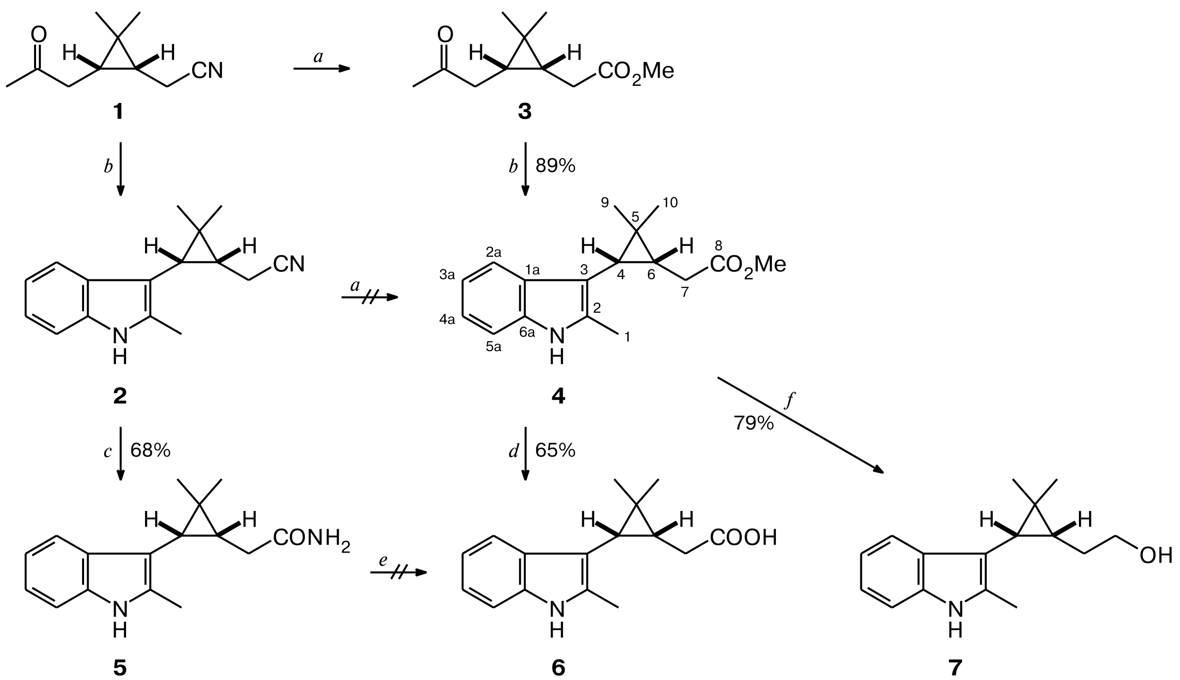
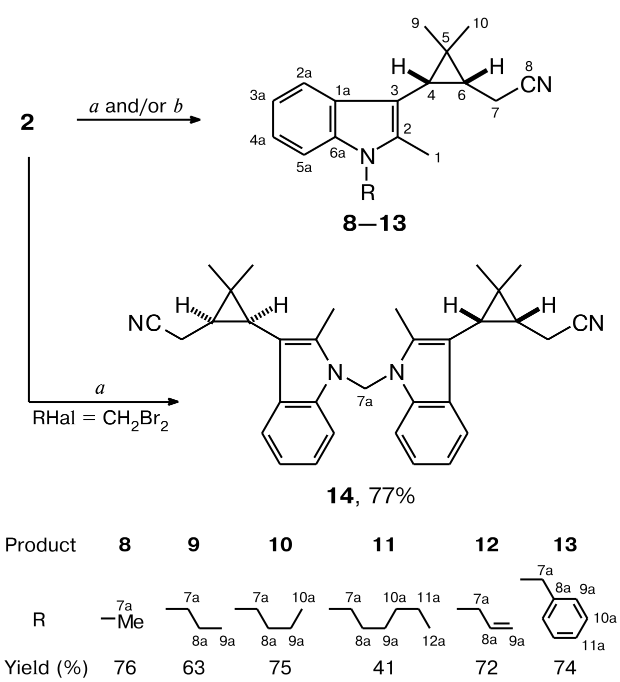
Scheme 1



Reagents and conditions: *a*. 1) HCl gaseous, MeOH, 20 °C, 3 h; 2) H_2O, 12 h (Ref. 15). *b*. (1) $PhNHNH_2$/MeOH, ~20 °C, 2 h; (2) PPE, CH_2Cl_2, ~20 °C, 12 h (Ref. 14). *c*. H_2O_2/NaOH/MeOH/H_2O, ~35 °C, 6 h. *d*. NaOH/EtOH/H_2O, ~20 °C, 3 h. *e*. H_2SO_4 conc., ~20 °C, 24 h. *f*. $LiAlH_4$/Et_2O, ~20 °C, 0.5 h.

Scheme 2



Reagents and conditions: *a*. RHal/CH_2Cl_2/50% aqueous NaOH/TEBAC, ~50 °C, 3 h. *b*. RHal (R = Me, All)/C_6H_6 or Bu^tOMe/Bu^tOK/18-crown-6, reflux, 8—14 h.

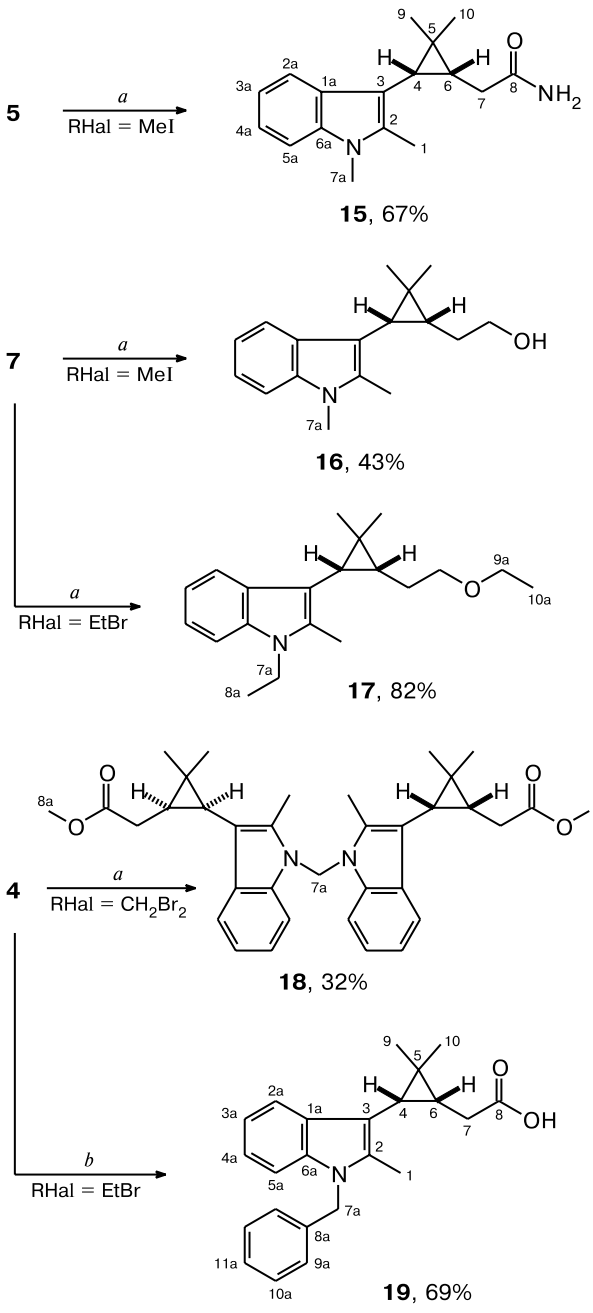
Only bisindolylmethane **14** is formed under the aqueous conditions (NaOH—TEBAC) when dibromomethane is used as the alkylating agent, regardless of alkyl halide : indole molar ratios, and the *N*-(bromomethyl) derivative is not formed.

The reaction of amide **5** under aqueous conditions ceases at the stage of *N*-methylindole **15** formation, although a twofold excess of methyl iodide is used (Scheme 3). The alkylation of the amide group, which can occur under similar conditions of phase-transfer catalysis,[16—19] is not observed. According to the spectroscopic and physicochemical data, we obtained the same compound using the encounter synthesis by the hydrolysis of nitrile **8** under conditions of the Radziszewski reaction.

The alkylation of alcohol **7** and ester **4** is less selective, and the yields of 1-alkylated indole derivatives **16** and **18** are 43 and 32%, respectively. The alkylation of alcohol **7** with one equivalent of methyl iodide afforded a mixture of products, among which compound **16** predominated (^{1}H NMR spectroscopic data). The product of *N*,*O*-dialkylation (**17**) becomes the main component when an excess of EtBr is used as the alkylating agent (see Scheme 3). Based on these data, we can assume that alkylation by methyl iodide would afford both monoalkylation (*N*- or *O*-) and dialkylation products.

In the reaction of ester **4** with CH_2Br_2 under aqueous-alkaline conditions, a partial hydrolysis of the ester group

Scheme 3



Reagents and conditions: *a*. RHal/CH_2Cl_2/50% aqueous NaOH/TEBAC, ~20 °C, 5—20 h. *b*. $PhCH_2Cl$/50% aqueous NaOH/TEBAC, ~75 °C, 4 h.

occurs in parallel with alkylation already at room temperature. That is why, the yield of product **18** is only 32%. The use of the anhydrous system (Bu^tOK—18-crown-6) is less efficient for the synthesis of bisindolo ester **18**. The *N*-alkylation of ester **4** with simultaneous hydrolysis of the ester group under the so-called "extractive alkylation" conditions seems more convenient in the preparative respect.[20] This method has previously been used for the *N*-alkylation of methyl 3-indolyl acetate and some derivatives of this acid.[21] In our case, the *N*-benzyl derivative of indolo acid **6** (compound **19**) can be obtained in 69% yield by storing a mixture of ester **4** with a sixfold excess of benzyl chloride and TEBAC at 70—75 °C.

It was of interest to alkylate indolylcyclopropylacetic acid at the carboxyl group avoiding the interaction with the heterocycle. This transformation was successfully performed in an alkyl halide—Na_2CO_3—DMF system. Esters **20—25** were obtained under the same conditions in yields from 30 to 88%, including bromine-containing compounds **21** and **22**, which were synthesized using an excess of alkylating agents, *viz.*, 1,2-dibromoethane and 1,5-dibromopentane, respectively (Scheme 4). The expected bisindoles **24** and **25** are formed in a twofold excess of acid **6** with respect to dihalides.

The exhaustive *N*- and *O*-alkylation of acid **6** was carried out under the conditions used earlier for the *N*-alkylation of ester **4**. Dibenzyl derivative **26** was obtained upon storing the acid at ~60—65 °C for 6 h (see Scheme 4).

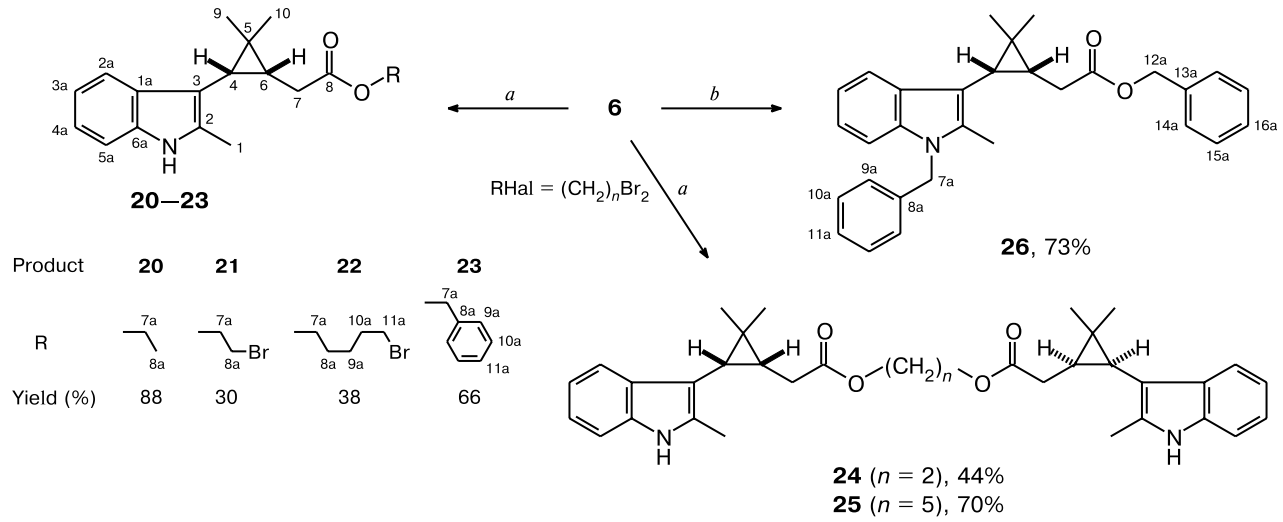
An aqueous-alkaline medium used along with TEBAC allows the *N*-sulfonylation of the indole cycle of nitrile **2** by *p*-toluenesulfonyl chloride and *p*-bromobenzenesulfonyl chloride (compounds **27** and **28**), and sulfonylation occurs much more rapidly and in a higher yield than alkylation (Scheme 5). This reaction is often used in synthesis for the introduction of the $—SO_2Ar$ protective group at the nitrogen atom of various indole compounds.[22—24]

The attempts of *N*-acetylation or *N*-benzoylation of indole **2** under the conditions repeatedly described for the acylation of 2,3-unsubstituted or monosubstituted indoles[25—27] were unsuccessful: none of the experiments exhibited acylation. The single *N*-acyl derivative, *viz.*, formylindole **29**, was obtained in 75% yield only under the Vilsmeier—Haak conditions.[28,29] When 1,2,3-trialkyl-substituted indole **8** is used, formylation occurs, as expected,[30,31] at the methyl group to position 2 of the heterocycle to form aldehyde **30**.

It should be mentioned in conclusion that the initial compounds are not epimerized in all reactions presented (*cf.* Ref. 32): all final products demonstrate the *cis*-arrangement of the substituents in the cyclopropane fragment. The cisoid arrangement of the substituents is unambiguously indicated by the $^3J_{4,6}$ spin-spin coupling constant, which varies from 8.0 to 9.7 Hz, depending on the compound. In addition, all synthesized compounds possess an optical activity ($[\alpha]_{578}$ +36—+167). These two facts suggests that the products are not racemized during the reactions under study.

Thus, in this work we showed that for 2,3-dialkyl-substituted 3-indolylcyclopropylacetic acid and its some derivatives the heterocycle can selectively be *N*-alkylated

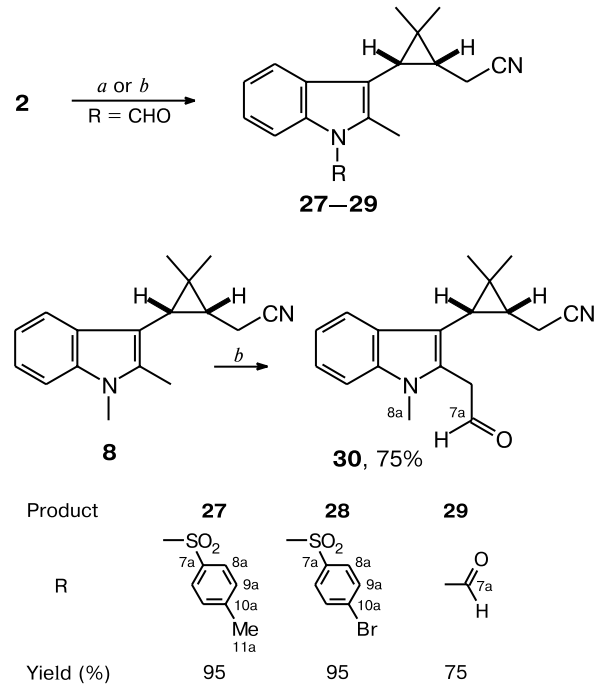
Scheme 4



Reagents and conditions: *a*. RHal/Na_2CO_3/DMF, ~20 °C, 10—40 h. *b*. $PhCH_2Cl$/50% aqueous NaOH/TEBAC, ~65 °C, 6 h.

without formation of the 3-alkylation products or alkylation can be performed only to the side chain of the heterocycle. If necessary, the conditions for exhaustive *N*,*O*-dialkylation can easily be selected. In addition, these compounds exhibited a low reactivity in the *N*-acylation of the indole heterocycle.

Scheme 5



Reagents and conditions: *a*. $ArSO_2Cl/CH_2Cl_2$/50% aqueous NaOH/TEBAC, ~20 °C, 1 h. *b*. $POCl_3$/DMF, ~20 °C, 5—70 h.

Experimental

Thin-layer chromatography was carried out on Silufol plates. In order to develop spots, the plates were sprayed with ethanolic solutions of vanillin (1 g of vanillin and 10 mL of concentrated H_2SO_4 in 100 mL of 95% EtOH) or ninhydrin (0.25 g of ninhydrin and 25 mL of AcOH in 100 mL of 95% EtOH) and then heated. Silica gel (KSK trade mark) with a particle size of 0.140—0.315 mm activated at 140 °C for 6—7 h was used for preparative column chromatography.

All organic solvents were distilled before use; triethylbenzylammonium chloride (TEBAC), Bu^tOK, and 18-crown-6 were commercially available (Fluka AG). Keto nitrile **1** ($[\alpha]_{578}^{23}$ −12.0 (in the pure form)) and methyl ester **3** ($[\alpha]_D^{20}$ −22.1 (*c* 1.99), *cf.* Ref. 33: $[\alpha]_D^{34}$ −26.6 (*c* 6.32)) were synthesized using a described procedure.[15]

UV spectra were obtained on a Specord M-40 spectrophotometer in 95% EtOH ($c = 1 \cdot 10^{-4}$ mol L^{-1}). IR spectra were recorded on a Bruker Vector-22 instrument. Mass spectra were obtained on a Finnigan MAT 8200 spectrometer (50—100 °C, EI, 70 eV). ^1H and ^{13}C NMR spectra were recorded on Bruker AC-200 (200.13 MHz (^1H) and 50.32 MHz (^{13}C)), Bruker AM-400 (400.13 MHz (^1H) and 100.61 MHz (^{13}C)), and Bruker DRX-500 (500.13 MHz (^1H) and 125.77 MHz (^{13}C)) spectrometers for solutions with a concentration of 70—100 mg mL^{-1} at 25—27 °C. The signals from the following solvents were used as the internal standard: $CDCl_3$ (δ_H = 7.24 ppm, δ_C = 76.90 ppm), CD_3OD (δ_H = 3.31 ppm, δ_C = 49.00 ppm), $(CD_3)_2SO$ (δ_H = 2.50 ppm, δ_C = 39.50 ppm), $(CD_3)_2CO$ (δ_H = 2.04 ppm, δ_C = 29.80 ppm), and pyridine-d_5 (δ_H = 8.71, 7.55, and 7.19 ppm, δ_C = 149.90, 135.50, and 123.50 ppm). Optical rotation angles were measured on a Polamat A polarimeter for solutions in $CHCl_3$ (if another solvent is not indicated). Melting points were determined on a Kofler stage.

***N*-Alkylation of indole 2 (general procedures). Method *A*.** A 50% aqueous solution of NaOH (10 mL) and alkyl halide were successively added with stirring to a solution of indole **2** and

TEBAC (0.10 g) in CH_2Cl_2 (10 mL), and the mixture was vigorously stirred either at ~20 °C or on heating. After the initial indole disappeared (TCL monitoring), the reaction mixture was diluted with water (20 mL), the organic layer was separated, and the aqueous layer was extracted with CH_2Cl_2 (2×10 mL). The combined organic extract was washed with a saturated solution of NaCl and dried with anhydrous Na_2SO_4. The solvent was removed *in vacuo*, and the residue was chromatographed using an EtOAc—petroleum ether mixture as the eluent. The product was obtained as a viscous light yellow oil. The crystalline substances were recrystallized.

Method *B*. Solutions of indole **2** (1 equiv.) and alkyl halide (2.2 equiv.) in Bu^{t}OMe were consecutively added with stirring to a suspension of 18-crown-6 (0.1 equiv.) and Bu^{t}OK (1.1 equiv.) in anhydrous Bu^{t}OMe, and the mixture was stirred for 1 h at ~20 °C and boiled for several hours until the initial indoles disappeared (TLC monitoring). The reaction mixture was diluted with water (20 mL), the organic layer was separated, and the aqueous layer was extracted with Bu^{t}OMe (3×15 mL). The combined organic extract was washed with a saturated solution of NaCl and dried above anhydrous Na_2SO_4. The solvent was removed *in vacuo*, and the residue was chromatographed on silica gel using an EtOAc—petroleum ether mixture as the eluent.

***O*-Alkylation of acid 6 (general procedure). Method *C*.** Na_2CO_3 (0.11 g, 1.1 mmol) was added to a solution of acid **6** (0.26 g, 1.0 mmol) in DMF (10 mL), and the mixture was stirred for 10 min. Then alkyl halide was added, and the mixture was stirred at ~20 °C for several hours. After the starting acid disappeared (TLC monitoring), the reaction mixture was diluted with water (50 mL) and extracted with Bu^{t}OMe (3×15 mL). The organic extract was washed with a saturated solution of NaCl and dried with anhydrous Na_2SO_4. The solvent was removed *in vacuo*, and the residue was chromatographed on silica gel using an EtOAc—petroleum ether mixture as the eluent.

Methyl (+)-[(1*R*,3*S*)-2,2-dimethyl-3-(2-methyl-1*H*-indol-3-yl)cyclopropyl] acetate (4). A solution of keto ester **3** (0.59 g, 3.0 mmol) and phenylhydrazine (0.36 g, 3.3 mmol) in MeOH (10 mL) was stored for 2 h at 20 °C, and the solvent was removed *in vacuo*. The residue in the form of a light yellow oil was dissolved in anhydrous CH_2Cl_2 (10 mL), PPE (2.0 g) was added,[34] and the mixture was stirred to complete dissolution and left for 12 h at 20 °C. After the solvent was removed, a residual dark brown oil was stirred with an aqueous solution (15 mL) of Na_2CO_3 (0.5 mol L^{-1}) and extracted with Bu^{t}OMe (3×10 mL). The ether extract was dried with anhydrous Na_2SO_4, and the solvent was removed *in vacuo*. The residue was chromatographed on a column packed with SiO_2 using an AcOEt—petroleum ether mixture as the eluent to isolate product **4** in 89% yield (0.72 g) as a viscous light orange oil with $[\alpha]_{578}^{23}$ +63.9 (*c* 4.21). UV (EtOH), λ_{max}/nm (ε): 226 (22500), 275 (7900), 292 (6400). IR (CCl_4), ν/cm^{-1}: 3475 (NH_{indole}), 3050 ($C—H_{arom}$), 1745 (C=O), 1455 ($C=C_{arom}$), 1430, 1170, and 1155 (C—O—C). ^{1}H NMR ($CDCl_3$), δ: 0.98 (s, 3 H, $H_3C(9)$); 1.37 (s, 3 H, $H_3C(10)$); 1.38 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 8.6 Hz, J_3 = 6.0 Hz); 1.75 (dq, 1 H, H(4), J_1 = 8.6 Hz, J_2 = 1.0 Hz); 2.07 (dd, 1 H, H(7α), J_1 = 18.0 Hz, J_2 = 9.0 Hz); 2.33 (d, 3 H, $H_3C(1)$, J = 1.0 Hz); 2.63 (dd, 1 H, H(7β), J_1 = 18.0 Hz, J_2 = 6.0 Hz); 3.67 (s, 3 H, $H_3C(7a)$); 7.04 (ddd, 1 H, H(3a), J_1 = 7.0 Hz, J_2 = 6.5 Hz, J_3 = 2.0 Hz); 7.09 (ddd, 1 H, H(4a), J_1 = 7.0 Hz, J_2 = 7.0 Hz, J_3 = 2.0 Hz); 7.22 (dd, 1 H, H(2a), J_1 = 6.5 Hz, J_2 = 2.0 Hz); 7.47 (dd, 1 H, H(5a), J_1 = 7.0 Hz, J_2 = 2.0 Hz); 7.75 (br.s, 1 H, NH). ^{13}C NMR ($CDCl_3$), δ: 12.66 (q, C(1)); 17.07 (q, C(9)); 18.20 (s, C(5)); 22.36 and 22.46 (both d, C(4), C(6)); 28.73 (q, C(10)); 31.49 (t, C(7)); 51.30 (q, C(7a)); 108.30 (s, C(3)); 109.90 (d, C(5a)); 118.89, 119.32, and 120.83 (all d, C(2a), C(3a), C(4a)); 129.75 (s, C(1a)); 133.83 and 135.49 (both s, C(2), C(6a)); 174.35 (s, C(8)). MS, *m/z* (I_{rel} (%)): 271 [M]$^+$ (41), 199 (15), 198 (100), 196 (13), 183 (13), 182 (20), 168 (15), 167 (9), 144 (9), 131 (14). Found: *m/z* 271.1575 [M]$^+$. $C_{17}H_{21}NO_2$. Calculated: M = 271.1572.

(+)-[(1*R*,3*S*)-2,2-Dimethyl-3-(2-methyl-1*H*-indol-3-yl)cyclopropyl]acetamide (5). Powdered NaOH (0.12 g, 3.0 mmol) was added together with dropwise adding of a 30% aqueous solution of H_2O_2 (3 mL) to a solution of nitrile **2** (0.71 g, 3.0 mmol) in MeOH (20 mL) maintaining the temperature at 30—40 °C. After the starting nitrile disappeared (~6 h, TLC monitoring), the reaction mixture was cooled to ~20 °C, and the solution was saturated with solid NaCl and extracted with $CHCl_3$ (3×10 mL). A chloroformic extract was washed with an aqueous solution of Na_2SO_3 (0.5 mol L^{-1}) and dried with anhydrous $MgSO_4$. The solvent was removed *in vacuo*, the yellow oil that formed was treated with a C_6H_6—$CHCl_3$ (1 : 1) mixture (10 mL) on heating, and the precipitate that formed was filtered off. After recrystallization from an aqueous solution of dioxane, amide **5** was obtained in 68% yield (0.52 g) with m.p. 157—159 °C, $[\alpha]_{578}^{32}$ +166.8 (*c* 1.81, MeOH). UV (EtOH), λ_{max}/nm (ε): 227 (34700), 284 (7400), 291 (6700). IR (KBr), ν/cm^{-1}: 3450 (NH_{indole}), 3400 (NH_{amide}), 3200 (NH_{amide}), 3070 ($C—H_{arom}$), 1665 (C=O), 1455 ($C=C_{arom}$), 730 ($C—H_{arom}$). ^{1}H NMR ($CDCl_3$—CD_3OD), δ: 0.91 (s, 3 H, $H_3C(9)$); 1.26 (ddd, 1 H, H(6), J_1 = 9.5 Hz, J_2 = 9.2 Hz, J_3 = 5.5 Hz); 1.28 (s, 3 H, $H_3C(10)$); 1.64 (dq, 1 H, H(4), J_1 = 9.2 Hz, J_2 = 1.2 Hz); 1.82 (dd, 1 H, H(7α), J_1 = 17.0 Hz, J_2 = 9.5 Hz); 2.25 (d, 3 H, $H_3C(1)$, J = 1.2 Hz); 2.50 (dd, 1 H, H(7β), J_1 = 17.0 Hz, J_2 = 5.5 Hz); 3.39 (s, 2 H, NH_{amide}); 6.89—6.97 (m, 2 H, H(3a), H(4a)); 7.10 (m, 1 H, H(2a)); 7.37 (m, 1 H, H(5a)); 8.82 (br.s, 1 H, NH_{indole}). ^{13}C NMR ($CDCl_3$—CD_3OD), δ: 12.53 (q, C(1)); 16.70 (q, C(9)); 18.13 (s, C(5)); 22.20 and 22.44 (both d, C(4), C(6)); 28.46 (q, C(10)); 32.73 (t, C(7)); 107.34 (s, C(3)); 109.90 (d, C(5a)); 118.32, 118.92, and 120.25 (all d, C(2a), C(3a), C(4a)); 129.39 (s, C(1a)); 134.27 and 135.50 (both s, C(2), C(6a)); 176.76 (s, C(8)). MS, *m/z* (I_{rel} (%)): 257 [M + H]$^+$ (9), 256 [M]$^+$ (47), 212 (12), 199 (16), 198 (100), 196 (13), 183 (15), 182 (29), 168 (19), 167 (12), 144 (30), 143 (8), 131 (40), 130 (15). Found: *m/z* 256.1573 [M]$^+$. $C_{16}H_{20}N_2O$. Calculated: M = 256.1576.

(+)-[(1*R*,3*S*)-2,2-Dimethyl-3-(2-methyl-1*H*-indol-3-yl)cyclopropyl]acetic acid (6). A 10% aqueous solution of NaOH (5 mL) was added to a solution of ester **4** (0.54 g, 2.0 mmol) in EtOH (10 mL). The mixture was stirred and left at ~20 °C for 3 h. Then the mixture was neutralized with an aqueous solution of HCl (1 mol L^{-1}) to pH 5 and extracted with Bu^{t}OMe (3×15 mL). The extract was dried with anhydrous Na_2SO_4, and the solvent was removed *in vacuo*. The residue was chromatographed, and acid **6** was obtained in 65% yield (0.33 g) as light yellow crystals with m.p. 67—69 °C (from EtOAc—hexane), $[\alpha]_{578}^{23}$ +90.6 (*c* 2.34). UV (EtOH), λ_{max}/nm (ε): 227 (29400), 284 (6100), 292 (5600). IR (CCl_4), ν/cm^{-1}: 3475 (NH_{indole}), 3055 ($C—H_{arom}$), 1705 (C=O), 1455 ($C=C_{arom}$), 1290 and 1225. ^{1}H NMR ($CDCl_3$—CCl_4), δ: 1.03 (s, 3 H, $H_3C(9)$); 1.39 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 9.0 Hz, J_3 = 5.8 Hz); 1.41 (s, 3 H, $H_3C(10)$); 1.75 (dq, 1 H, H(4), J_1 = 9.0 Hz, J_2 = 1.0 Hz); 2.10

(dd, 1 H, H(7α), J_1 = 18.2 Hz, J_2 = 9.0 Hz); 2.32 (d, 3 H, $H_3C(1)$, J = 1.0 Hz); 2.71 (dd, 1 H, H(7β), J_1 = 18.2 Hz, J_2 = 5.8 Hz); 6.02—7.13 (m, 3 H, H(2a), H(3a), H(4a)); 7.46 (d, 1 H, H(5a), J = 7.5 Hz); 7.66 (s, 1 H, N_{indole}); 11.78 (br.s, 1 H, COOH). ^{13}C NMR ($CDCl_3$—CCl_4), δ: 12.90 (q, C(1)); 17.26 (q, C(9)); 18.28 (s, C(5)); 22.10 and 22.47 (both d, C(4), C(6)); 28.91 (q, C(10)); 31.61 (t, C(7)); 108.13 (s, C(3)); 109.96 (d, C(5a)); 119.11, 119.34, and 121.02 (all d, C(2a), C(3a), C(4a)); 129.72 (s, C(1a)); 133.38 and 135.54 (both s, C(2), C(6a)); 180.48 (s, C(8)). MS, m/z (I_{rel} (%)): 257 $[M]^+$ (38), 199 (16), 198 (100), 183 (13), 182 (16), 168 (13), 167 (7), 144 (12), 131 (15), 43 (7). Found: m/z 257.1423 $[M]^+$. $C_{16}H_{19}NO_2$. Calculated: M = 257.1416.

(+)-2-[(1*R*,3*S*)-2,2-Dimethyl-3-(2-methyl-1*H*-indol-3-yl)cyclopropyl]ethanol (7). A solution of ester **4** (0.27 g, 1.0 mmol) in Et_2O was added dropwise to a suspension of $LiAlH_4$ (0.08 g, 2.0 mmol) in Et_2O (10 mL), and the reaction mixture was stirred for 30 min at ~20 °C. The residue of $LiAlH_4$ was decomposed with EtOAc (10 mL), after which an aqueous solution (50 mL) of HCl (4 mol L^{-1}) was added to the mixture. The organic layer was separated, and the aqueous solution was extracted with EtOAc (2×10 mL). The combined organic extract was washed with a solution of Na_2CO_3 (0.5 mol L^{-1}) and a saturated solution of NaCl. After drying the extract above anhydrous Na_2SO_4, removal of the solvent *in vacuo*, and chromatography of the residue on silica gel (30% EtOAc in petroleum ether as the eluent), alcohol **7** was obtained in 79% yield (0.19 g) as a viscous light yellow oil with $[\alpha]_{578}^{25}$ +60.3 (*c* 2.02). UV (EtOH), λ_{max}/nm (ε): 228 (30600), 284 (6300), 293 (5900). IR ($CHCl_3$), ν/cm^{-1}: 3625 (OH), 3470 (NH_{indole}), 1460 ($C{=}C_{arom}$), 1015, 785, 730, and 660 ($C{-}H_{arom}$). ^{1}H NMR ($CDCl_3$), δ: 0.97 (ddd, 1 H, H(6), J_1 = 8.8 Hz, J_2 = 4.0 Hz, J_3 = 3.5 Hz); 1.02 (s, 3 H, $H_3C(9)$); 1.25 (dddd, 1 H, H(7α), J_1 = 18.5 Hz, J_2 = 7.1 Hz, J_3 = 7.1 Hz, J_4 = 4.0 Hz); 1.34 (s, 3 H, $H_3C(10)$); 1.69 (dq, 1 H, H(4), J_1 = 8.8 Hz, J_2 = 1.0 Hz); 1.89 (br.s, 1 H, OH); 1.98 (dddd, 1 H, H(7β), J_1 = 18.5 Hz, J_2 = 7.1 Hz, J_3 = 7.1 Hz, J_4 = 3.5 Hz); 2.34 (d, 3 H, $H_3C(1)$, J_1 = 1.0 Hz); 3.68 (t, 2 H, $H_2C(8)$, J = 7.1 Hz); 7.02—7.19 (m, 3 H, H(2a), H(3a), H(4a)); 7.51—7.58 (m, 1 H, H(5a)); 7.88 (br.s, 1 H, NH). ^{13}C NMR ($CDCl_3$), δ: 13.04 (q, C(1)); 17.24 (q, C(9)); 18.03 (s, C(5)); 22.68 and 23.83 (both d, C(4), C(6)); 29.23 (q, C(10)); 30.17 (t, C(7)); 63.16 (t, C(8)); 108.79 (s, C(3)); 109.86 (d, C(5a)); 118.55, 119.55, and 120.51 (all d, C(2a), C(3a), C(4a)); 129.86 (s, C(1a)); 133.75 and 135.37 (both s, C(2), C(6a)). MS, m/z (I_{rel} (%)): 243 $[M]^+$ (50), 212 (26), 199 (17), 198 (100), 183 (17), 182 (23), 170 (14), 169 (13), 168 (26), 167 (14), 144 (26), 131 (25), 130 (11). Found: m/z 243.1624 $[M]^+$. $C_{16}H_{21}NO$. Calculated: M = 243.1623.

(+)-[(1*R*,3*S*)-2,2-Dimethyl-3-(1,2-dimethyl-1*H*-indol-3-yl)cyclopropyl]acetonitrile (8). *Method 1.* Compound **8** was synthesized using method *A* from indole **2** (0.48 g, 2.0 mmol) and MeI (0.43 g, 3.0 mmol). The reaction was carried out at ~20 °C for 4 h. After a standard treatment, a crystalline substance (0.49 g) was obtained, whose recrystallization from 80% aqueous EtOH gave product **8** in 82% yield (0.41 g).

Method 2. Compound **8** was synthesized using method *B* from 18-crown-6 (0.05 g, ~0.2 mmol), Bu^tOK (0.26 g, 2.3 mmol), indole **2** (0.48 g, 1.0 mmol), and MeI (0.43 g, 3.0 mmol) in Bu^tOMe (70 mL). The mixture was refluxed for 8 h until the reaction ceased. After a standard treatment, a crystalline substance (0.50 g) was isolated and recrystallized from 80% aqueous EtOH, and product **8** was obtained in 77% yield (0.39 g) with m.p. 118—121 °C (from aqueous EtOH), $[\alpha]_{578}^{23}$ +128.7 (*c* 3.92). UV (EtOH), λ_{max}/nm (ε): 228 (35600), 286 (7200), 294 (6800). IR (KBr), ν/cm^{-1}: 3050 ($C{-}H_{arom}$), 2250 (C≡N), 1460 ($C{=}C_{arom}$), 1370, 1240, 735, and 705 ($C{-}H_{arom}$). ^{1}H NMR (acetone-d_6), δ: 1.08 (s, 3 H, $H_3C(9)$); 1.34 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 8.5 Hz, J_3 = 6.0 Hz); 1.36 (s, 3 H, $H_3C(10)$); 1.80 (dq, 1 H, H(4), J_1 = 8.5 Hz, J_2 = 1.0 Hz); 1.96 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 9.0 Hz); 2.37 (d, 3 H, $H_3C(1)$, J = 1.0 Hz); 2.74 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 6.0 Hz); 3.65 (s, 3 H, $H_3C(7a)$); 6.98 (ddd, 1 H, H(4a), J_1 = 9.0 Hz, J_2 = 8.0 Hz, J_3 = 1.0 Hz); 7.09 (ddd, 1 H, H(3a), J_1 = 9.0 Hz, J_2 = 7.5 Hz, J_3 = 1.0 Hz); 7.26 (dd, 1 H, H(2a), J_1 = 7.5 Hz, J_2 = 1.0 Hz); 7.48 (dd, 1 H, H(5a), J_1 = 8.0 Hz, J_2 = 1.0 Hz). ^{13}C NMR (acetone-d_6), δ: 11.94 (q, C(1)); 15.25 (t, C(7)); 16.91 (q, C(9)); 19.12 (s, C(5)); 23.67 and 23.83 (both d, C(4), C(6)); 28.69 (q, C(10)); 29.71 (q, C(7a)); 106.50 (s, C(3)); 109.54 (d, C(5a)); 119.47, 119.67, and 121.27 (all d, C(2a), C(3a), C(4a)); 120.89 (s, C(8)); 129.37 (s, C(1a)); 137.30 and 137.95 (both s, C(2), C(6a)). MS, m/z (I_{rel} (%)): 252 $[M]^+$ (16), 213 (17), 212 (100), 198 (5), 197 (11), 196 (14), 182 (16), 181 (6), 97 (5). Found: m/z 252.1627 $[M]^+$. $C_{17}H_{20}N_2$. Calculated: M = 252.1626.

(+)-[(1*R*,3*S*)-2,2-Dimethyl-3-(2-methyl-1-propyl-1*H*-indol-3-yl)cyclopropyl]acetonitrile (9) was synthesized using method *A* from indole **2** (0.48 g, 2.0 mmol) and Pr^nBr (0.37 g, 3.0 mmol). The reaction was carried out for 3 h on heating (~50 °C). After a standard treatment and chromatography, product **9** was obtained in 63% yield (0.35 g) with $[\alpha]_{578}^{22}$ +126.5 (*c* 3.15). UV (EtOH), λ_{max}/nm (ε): 229 (32900), 286 (7100), 294 (6700). IR ($CHCl_3$), ν/cm^{-1}: 2250 (C≡N), 1730, 1465 ($C{=}C_{arom}$), 1355, 1220, 1190. ^{1}H NMR ($CDCl_3$—CCl_4), δ: 0.96 (t, 3 H, $H_3C(9a)$, J = 7.5 Hz); 1.13 (s, 3 H, $H_3C(9)$); 1.22—1.37 (m, 1 H, H(6)); 1.41 (s, 3 H, $H_3C(10)$); 1.77 (m, 2 H, $H_2C(8a)$); 1.85 (d, 1 H, H(4), J = 9.7 Hz); 1.95 (dd, 1 H, H(7α), J_1 = 18.0 Hz, J_2 = 9.0 Hz); 2.37 (s, 3 H, $H_3C(1)$); 2.61 (dd, 1 H, H(7β), J_1 = 18.0 Hz, J_2 = 6.0 Hz); 4.01 (t, 2 H, $H_2C(7a)$, J = 7.8 Hz); 6.92—7.08 (m, 2 H, H(3a), H(4a)); 7.20 (m, 1 H, H(2a)); 7.40 (m, 1 H, H(5a)). ^{13}C NMR ($CDCl_3$—CCl_4), δ: 11.43 and 11.78 (both q, C(1), C(9a)); 15.01 (t, C(7)); 16.51 (q, C(9)); 18.61 (s, C(5)); 22.48 (t, C(8a)); 23.08 and 23.27 (both d, C(4), C(6)); 28.47 (q, C(10)); 44.68 (t, C(7a)); 105.98 (s, C(3)); 108.77 (d, C(5a)); 118.81, 118.91, and 120.72 (all d, C(2a), C(3a), C(4a)); 119.50 (s, C(8)); 128.21 (s, C(1a)); 135.31 and 136.10 (both s, C(2), C(6a)). MS, m/z (I_{rel} (%)): 280 $[M]^+$ (16), 241 (19), 240 (100), 224 (6), 210 (6), 182 (6). Found: m/z 280.1931 $[M]^+$. $C_{19}H_{24}N_2$. Calculated: M = 280.1939.

(+)-[(1*R*,3*S*)-2,2-Dimethyl-3-(1-butyl-2-methyl-1*H*-indol-3-yl)cyclopropyl]acetonitrile (10) was synthesized using method *A* from indole **2** (0.48 g, 2.0 mmol) and Bu^nBr (0.41 g, 3.0 mmol). The reaction was carried out at ~50 °C for 3 h. After a standard treatment and chromatography, product **10** was obtained in 75% yield (0.44 g) with $[\alpha]_{578}^{24}$ +88.1 (*c* 1.79). UV (EtOH), λ_{max}/nm (ε): 229 (36300), 286 (7700), 294 (7500). IR (CCl_4), ν/cm^{-1}: 3055 ($C{-}H_{arom}$), 2250 (C≡N), 1465 ($C{=}C_{arom}$), 1365, 740 ($C{-}H_{arom}$). ^{1}H NMR ($CDCl_3$—CCl_4), δ: 1.05 (t, 3 H, $H_3C(10a)$, J = 8.0 Hz); 1.16 (s, 3 H, $H_3C(9)$); 1.32—1.48 (m, 3 H, H(6), $H_2C(9a)$); 1.44 (s, 3 H, $H_3C(10)$); 1.76 (m, 2 H, $H_2C(8a)$); 1.85 (d, 1 H, H(4), J = 9.7 Hz); 1.99 (dd, 1 H, H(7α), J_1 = 18.0 Hz, J_2 = 9.5 Hz); 2.40 (s, 3 H, $H_3C(1)$); 2.65 (dd, 1 H, H(7β), J_1 = 18.0 Hz, J_2 = 6.0 Hz); 4.06 (t, 2 H,

$H_2C(7a)$, J = 7.8 Hz); 7.04—7.16 (m, 2 H, H(3a), H(4a)); 7.23 (m, 1 H, H(2a)); 7.43 (m, 1 H, H(5a)). ^{13}C NMR ($CDCl_3$—CCl_4), δ: 11.76 (q, C(10a)); 13.84 (q, C(1)); 15.02 (t, C(7)); 16.53 (q, C(9)); 18.62 (s, C(5)); 20.24 (t, C(9a)); 22.46 and 23.07 (both d, C(4), C(6)); 28.48 (q, C(10)); 32.23 (t, C(8a)); 42.96 (t, C(7a)); 105.97 (s, C(3)); 108.72 (d, C(5a)); 118.81, 118.90, and 120.72 (all d, C(2a), C(3a), C(4a)); 119.52 (s, C(8)); 128.22 (s, C(1a)); 135.22 and 136.03 (both, C(2), C(6a)). MS, m/z (I_{rel} (%)): 294 $[M]^+$ (11), 255 (20), 254 (100), 238 (5), 224 (4), 182 (7), 181 (4), 180 (3), 168 (5), 167 (4), 41 (4). Found: m/z 294.2100 $[M]^+$. $C_{20}H_{26}N_2$. Calculated: M = 294.2096.

(+)-[(1*R*,3*S*)-2,2-Dimethyl-3-(1-hexyl-2-methyl-1*H*-indol-3-yl)cyclopropyl]acetonitrile (11) was synthesized using method *A* from indole **2** (0.48 g, 2.0 mmol) and 1-bromohexane (0.49 g, 3.0 mmol). The reaction was carried out at ~50 °C for 3 h. After a standard treatment and chromatography, product **11** was obtained in 42% yield (0.27 g) with $[\alpha]_{578}^{23}$ +88.1 (*c* 2.85). UV (EtOH), λ_{max}/nm (ε): 229 (33500), 286 (7100), 292 (6800). IR (CCl_4), ν/cm^{-1}: 3060 (C—H_{arom}), 2245 (C≡N), 1740, 1470 (C=C_{arom}), 1370, 1240, 1135, 810 (C—H_{arom}). ^1H NMR ($CDCl_3$—CCl_4), δ: 0.92 (m, 3 H, $H_3C(12a)$); 1.14 (s, 3 H, $H_3C(9)$); 1.31—1.39 (m, 7 H, H(6), $H_2C(9a)$, $H_2C(10a)$, $H_2C(11a)$); 1.42 (s, 3 H, $H_3C(10)$); 1.74 (m, 2 H, $H_2C(8a)$); 1.83 (dq, 1 H, H(4), J_1 = 8.4 Hz, J_2 = 1.0 Hz); 1.93 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 9.2 Hz); 2.38 (d, 3 H, $H_3C(1)$, J = 1.0 Hz); 2.63 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 5.8 Hz); 4.03 (t, 2 H, $H_2C(7a)$, J = 7.5 Hz); 7.01 (m, 1 H, H(3a)); 7.09 (m, 1 H, H(4a)); 7.20 (m, 1 H, H(2a)); 7.40 (m, 1 H, H(5a)). ^{13}C NMR ($CDCl_3$—CCl_4), δ: 11.81 (q, C(12a)); 13.97 (q, C(1)); 15.05 (t, C(7)); 16.55 (q, C(9)); 18.66 (s, C(5)); 22.52 (t, C(11a)); 22.47 and 23.08 (both d, C(4), C(6)); 26.72 (t, C(10a)); 28.53 (q, C(10)); 30.07 and 31.47 (both t, C(8a), C(9a)); 43.23 (t, C(7a)); 106.00 (s, C(3)); 108.74 (d, C(5a)); 118.65, 118.95, and 120.78 (all d, C(2a), C(3a), C(4a)); 119.56 (s, C(8)); 128.24 (s, C(1a)); 135.23 and 136.03 (both s, C(2), C(6a)). MS, m/z (I_{rel} (%)): 322 $[M]^+$ (9), 283 (22), 282 (100), 266 (3), 196 (3), 182 (5), 181 (3), 168 (4), 43 (7), 41 (4). Found: m/z 322.0296 $[M]^+$. $C_{22}H_{30}N_2$. Calculated: M = 322.0292.

(+)-{(1*R*,3*S*)-2,2-Dimethyl-3-[2-methyl-1-(2-propenyl-1*H*-indol-3-yl)]cyclopropyl]acetonitrile (12) was synthesized using method *B* from 18-crown-6 (0.03 g, ~0.1 mmol), Bu^tOK (0.12 g, 1.1 mmol), indole **2** (0.24 g, 1.0 mmol), and 3-bromopropene (0.27 g, 2.2 mmol) in anhydrous Bu^tOMe (25 mL). The mixture was refluxed for 14 h to the end of the reaction. After a standard treatment and chromatography, crystalline product **12** was obtained in 72% yield (0.20 g), with m.p. 55—57 °C (from EtOH), $[\alpha]_{578}^{24}$ +125.5 (*c* 4.11). UV (EtOH), λ_{max}/nm (ε): 228 (25800), 286 (6000), 294 (5700). IR (KBr), ν/cm^{-1}: 3030 (C—H_{arom}), 2240 (C≡N), 1465, 1455 (C=C_{arom}), 1375, 1320, 930, 765, and 755 (C—H_{arom}). ^1H NMR ($CDCl_3$), δ: 1.12 (s, 3 H, $H_3C(9)$); 1.35 (ddd, 1 H, H(6), J_1 = 9.5 Hz, J_2 = 9.0 Hz, J_3 = 6.0 Hz); 1.40 (s, 3 H, $H_3C(10)$); 1.86 (dq, 1 H, H(4), J_1 = 9.0 Hz, J_2 = 1.0 Hz); 1.95 (dd, 1 H, H(7α), J_1 = 18.0 Hz, J_2 = 9.5 Hz); 2.34 (d, 3 H, $H_3C(1)$, J = 1.0 Hz); 2.65 (dd, 1 H, H(7β), J_1 = 18.0 Hz, J_2 = 6.0 Hz); 4.67 (dt, 2 H, $H_2C(7a)$, J_1 = 5.0 Hz, J_2 = 1.5 Hz); 4.78 (ddt, 1 H, $H_{trans}(9a)$, J_1 = 17.0 Hz, J_2 = 2.0 Hz, J_3 = 1.5 Hz); 5.11 (ddt, 1 H, $H_{cis}(9a)$, J_1 = 10.5 Hz, J_2 = 2.0 Hz, J_3 = 1.5 Hz); 5.93 (ddt, 1 H, H(8a), J_1 = 17.0 Hz, J_2 = 10.5 Hz, J_3 = 5.0 Hz); 7.07 (ddd, 1 H, H(3a), J_1 = 8.0 Hz, J_2 = 5.5 Hz, J_3 = 2.0 Hz); 7.14 (ddd, 1 H, H(4a), J_1 = 7.0 Hz, J_2 = 5.5 Hz, J_3 = 2.0 Hz); 7.22 (dd, 1 H, H(2a), J_1 = 8.0 Hz, J_2 = 2.0 Hz); 7.47 (dd, 1 H, H(5a), J_1 = 7.0 Hz, J_2 = 2.0 Hz). ^{13}C NMR ($CDCl_3$), δ: 11.49 (q, C(1)); 15.04 (t, C(7)); 16.45 (q, C(9)); 18.62 (s, C(5)); 22.48 and 22.96 (both d, C(4), C(6)); 28.32 (q, C(10)); 45.22 (t, C(7a)); 106.30 (s, C(3)); 108.85 (d, C(5a)); 115.98 (t, C(9a)); 118.80, 119.06, and 120.81 (all d, C(2a), C(3a), C(4a)); 120.05 (s, C(8)); 128.26 (s, C(1a)); 133.15 (d, C(8a)); 135.86 and 136.21 (both s, C(2), C(6a)). MS, m/z (I_{rel} (%)): 279 $[M + H]^+$ (5), 278 $[M]^+$ (17), 239 (18), 238 (100), 223 (5), 208 (7), 197 (6), 182 (12), 181 (6), 167 (7), 41 (5). Found: m/z 278.1781 $[M]^+$. $C_{19}H_{22}N_2$. Calculated: M = 278.1783.

(+)-[(1*R*,3*S*)-2,2-Dimethyl-3-(1-benzyl-2-methyl-1*H*-indol-3-yl)cyclopropyl]acetonitrile (13) was synthesized using method *A* from indole **2** (0.48 g, 2.0 mmol) and $PhCH_2Cl$ (0.38 g, 3.0 mmol). The reaction was carried out at ~50 °C for 3 h. After a standard treatment and recrystallization from EtOH, product **13** was isolated in 84% yield (0.55 g) with m.p. 64—66 °C (from EtOH), $[\alpha]_{578}^{24}$ +110.1 (*c* 3.96). UV (EtOH), λ_{max}/nm (ε): 203 (35300), 226 (37600), 286 (8400), 294 (7900). IR (KBr), ν/cm^{-1}: 3050 (C—H_{arom}), 2245 (C≡N), 1490, 1465, 1450 (C=C_{arom}), 1190, 730, and 720 (C—H_{arom}). ^1H NMR ($CDCl_3$), δ: 1.15 (s, 3 H, $H_3C(9)$); 1.38 (ddd, 1 H, H(6), J_1 = 9.2 Hz, J_2 = 9.0 Hz, J_3 = 5.5 Hz); 1.41 (s, 3 H, $H_3C(10)$); 1.90 (dq, 1 H, H(4), J_1 = 9.0 Hz, J_2 = 1.2 Hz); 1.99 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 9.2 Hz); 2.32 (d, 3 H, $H_3C(1)$, J = 1.2 Hz); 2.68 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 5.5 Hz); 5.31 (s, 2 H, $H_2C(7a)$); 6.91—6.99 (m, 2 H, H(3a), H(4a)); 7.06—7.15 (m, 3 H, H(9a), H(11a)); 7.16—7.33 (m, 3 H, H(2a), H(10a)); 7.48—7.56 (m, 1 H, H(5a)). ^{13}C NMR ($CDCl_3$), δ: 11.73 (q, C(1)); 15.06 (t, C(7)); 16.46 (q, C(9)); 18.64 (s, C(5)); 22.42 and 22.97 (both d, C(4), C(6)); 28.30 (q, C(10)); 46.47 (t, C(7a)); 106.67 (s, C(3)); 109.03 (d, C(5a)); 118.85, 119.20, and 121.02 (all d, C(2a), C(3a), C(4a)); 120.02 (s, C(8)); 125.74 (two d, C(9a)); 127.19 (d, C(11a)); 128.31 (s, C(1a)); 128.66 (two d, C(10a)); 136.02 and 136.65 (both s, C(2), C(6a)); 137.57 (s, C(8a)). MS, m/z (I_{rel} (%)): 328 $[M]^+$ (13), 289 (24), 288 (100), 182 (5), 92 (6), 91 (85), 65 (6), 28 (4). Found: m/z 328.1945 $[M]^+$. $C_{23}H_{24}N_2$. Calculated: M = 328.1939.

(+)-Methylene-bis{3-[(1*R*,3*S*)-3-(cyanomethyl)-2,2-dimethyl-2-methylcyclopropyl]-1*H*-indole-1-yl} (14) was synthesized using method *A* from indole **2** (0.48 g, 2.0 mmol) and CH_2Br_2 (0.70 g, 4.0 mmol). The reaction mixture was vigorously stirred for 10 h at ~20 °C until the starting indole disappeared (TLC monitoring). After a standard treatment and recrystallization from DMF, product **14** was obtained in 77% yield (0.38 g) with m.p. 259—262 °C (from DMF), $[\alpha]_{578}^{22}$ +71.3 (*c* 0.64, DMF). UV (EtOH), λ_{max}/nm (ε): 226 (58600), 284 (15500), 293 (14100). IR (KBr), ν/cm^{-1}: 3050 (C—H_{arom}), 2245 (C≡N), 1455 (C=C_{arom}), 1300, 730 (C—H_{arom}). ^1H NMR (pyridine-d_5), δ: 1.01 (s, 3 H, $H_3C(9)$); 1.27 (s, 3 H, $H_3C(10)$); 1.29 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 8.8 Hz, J_3 = 6.0 Hz); 1.75 (d, 1 H, H(4), J_1 = 8.8 Hz); 1.95 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 9.0 Hz); 2.19 (s, 3 H, $H_3C(1)$); 2.59 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 6.0 Hz); 6.39 (s, 1 H, $H_2C(7a)$); 7.12—7.19 (m, 2 H, H(3a), H(4a)); 7.28 (d, 1 H, H(2a), J = 8.2 Hz); 7.62 (d, 1 H, H(5a), J = 8.0 Hz). ^{13}C NMR (pyridine-d_5), δ: 12.30 (q, C(1)); 15.17 (t, C(7)); 16.59 (q, C(9)); 18.88 (s, C(5)); 23.45 and 23.49 (both d, C(4), C(6)); 28.33 (q, C(10)); 53.71 (t, C(7a)); 109.14 (s, C(3)); 109.93 (d, C(5a)); 119.98, 120.40, and 122.11 (all d, C(2a), C(3a), C(4a)); 120.46 (s, C(8)); 129.55 (s, C(1a));

136.64 and 137.48 (both s, C(2), C(6a)). MS, *m/z* (I_{rel} (%)): 488 $[M]^+$ (6), 448 (12), 252 (19), 251 (100), 224 (5), 223 (17), 209 (5), 208 (12), 196 (9), 182 (5), 181 (8). Found: *m/z* 488.2947 $[M]^+$. $C_{33}H_{36}N_4$. Calculated: M = 488.2940.

(+)-[(1*R*,3*S*)-2,2-Dimethyl-3-(1,2-dimethyl-1*H*-indol-3-yl)cyclopropyl]acetamide (15). *Method 1.* Powdered NaOH (0.24 g, 6.0 mmol) was added to a solution of indole **8** (1.01 g, 4.0 mmol) in MeOH (20 mL), and then a 30% aqueous solution of H_2O_2 (10 mL) was added dropwise maintaining the temperature at 30—40 °C. After the initial nitrile disappeared (~8 h, TLC monitoring), the reaction mixture was cooled to ~20 °C, and the solution was saturated with solid NaCl and extracted with $CHCl_3$ (3×10 mL). The chloroformic extract was washed with an aqueous solution of Na_2SO_3 (0.5 mol L^{-1}) and dried with anhydrous $MgSO_4$. The solvent was removed *in vacuo*, and amide **15** was obtained in 78% yield (0.84 g), as a light yellow glassy substance.

Method 2. Compound **15** was synthesized using method *A* from indole **2** (0.51 g, 2.0 mmol) and MeI (0.71 g, 5.0 mmol). The reaction was carried out for 20 h on heating (~45 °C). After a standard treatment and chromatography, product **15** was obtained in 67% yield (0.36 g) as a colorless glassy substance with $[\alpha]_{578}^{31}$ +107.1 (*c* 1.40). UV (EtOH), λ_{max}/nm (ε): 230 (25500), 287 (5300), 293 (5100). IR ($CHCl_3$), ν/cm^{-1}: 3540 and 3410 (NH_{amide}), 1675 (C=O), 1460 (C=C_{arom}), 1375, 1240. ^{1}H NMR ($CDCl_3$), δ: 1.00 (s, 3 H, $H_3C(9)$); 1.34 (ddd, 1 H, H(6), J_1 = 9.5 Hz, J_2 = 8.5 Hz, J_3 = 6.0 Hz); 1.38 (s, 3 H, $H_3C(10)$); 1.77 (d, 1 H, H(4), *J* = 8.5 Hz); 1.89 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 9.5 Hz); 2.34 (s, 3 H, $H_3C(1)$); 2.57 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 6.0 Hz); 3.61 (s, 3 H, $H_3C(7a)$); 5.54 and 5.90 (both br.s, 1 H each, $CONH_2$); 6.98—7.14 (m, 3 H, H(2a), H(3a), H(4a)); 7.49 (d, 1 H, H(5a), *J* = 8.0 Hz). ^{13}C NMR ($CDCl_3$), δ: 11.64 (q, C(1)); 13.98 (q, C(9)); 18.22 (s, C(5)); 22.43 and 22.77 (both d, C(4), C(6)); 28.73 (q, C(10)); 29.25 (q, C(7a)); 32.99 (t, C(7)); 107.16 (s, C(3)); 108.21 (d, C(5a)); 118.47, 119.23, and 120.29 (all d, C(2a), C(3a), C(4a)); 128.53 (s, C(1a)); 135.86 and 136.58 (both s, C(2), C(6a)); 175.74 (s, C(8)). MS, *m/z* (I_{rel} (%)): 270 $[M]^+$ (30), 213 (16), 212 (100), 197 (13), 196 (18), 182 (16), 158 (14), 145 (23). Found: *m/z* 270.1732 $[M]^+$. $C_{17}H_{22}N_2O$. Calculated: M = 270.1732.

(+)-2-[(1*R*,3*S*)-2,2-Dimethyl-3-(1,2-dimethyl-1*H*-indol-3-yl)cyclopropyl]ethanol (16) was synthesized using method *A* from alcohol **7** (0.24 g, 1.0 mmol), TEBAC (0.04 g, 0.2 mmol), and MeI (0.14 g, 1.0 mmol). The reaction mixture was stirred for 5 h at ~20 °C, and an addition portion of MeI (0.05 g, 0.35 mmol) was added to cease the reaction (TLC monitoring). After a standard treatment and chromatography, *N*-methylindole **16** was obtained in 43% yield (0.11 g) as a light yellow oily substance with $[\alpha]_{578}^{27}$ +52.3 (*c* 1.99, EtOAc). UV (EtOH), λ_{max}/nm (ε): 205 (16500), 229 (22500), 286 (5800), 293 (5700). IR (CCl_4), ν/cm^{-1}: 3635 (O—H), 3060 (C—H_{arom}), 1715, 1470 (C=C_{arom}), 1375, 1220, 810, 740 (C—H_{arom}). ^{1}H NMR (acetone-d_6), δ: 1.00 (s, 3 H, $H_3C(9)$); 1.00—1.31 (m, 2 H, H(6), H(7α)); 1.33 (s, 3 H, $H_3C(10)$); 1.64 (dq, 1 H, H(4), J_1 = 8.8 Hz, J_2 = 1.2 Hz); 2.01—2.09 (m, 1 H, H(7β)); 2.38 (d, 3 H, $H_3C(1)$, *J* = 1.2 Hz); 2.98 (br.s, 1 H, OH); 3.62 (s, 3 H, $H_3C(7a)$); 3.62 (t, 2 H, $H_2C(8)$, *J* = 7.0 Hz); 6.96—7.06 (m, 2 H, H(3a), H(4a)); 7.24 (dd, 1 H, H(2a), J_1 = 7.2 Hz, J_2 = 1.2 Hz); 7.52 (dd, 1 H, H(5a), J_1 = 7.2 Hz, J_2 = 1.2 Hz). ^{13}C NMR (acetone-d_6), δ: 12.16 (q, C(1)); 17.77 (q, C(9)); 18.63 (s, C(5)); 23.70 (d, C(4)); 25.06 (d, C(6)); 29.59 (q, C(10)); 29.80 (q, C(7a)); 31.34 (t, C(7)); 63.09 (t, C(8)); 108.71 (s, C(3)); 109.21 (d, C(5a)); 118.94, 119.15, and 119.48 (all d, C(2a), C(3a), C(4a)); 129.99 (s, C(1a)); 136.62 and 137.80 (both s, C(2), C(6a)). MS, *m/z* (I_{rel} (%)): 258 $[M + H]^+$ (10), 257 $[M]^+$ (52), 226 (21), 213 (17), 212 (100), 196 (15), 182 (17), 158 (13), 145 (16). Found: *m/z* 257.1780 $[M]^+$. $C_{17}H_{23}NO$. Calculated: M = 257.1780.

(+)-2-[(1*R*,3*S*)-2,2-Dimethyl-3-(1-ethyl-2-methyl-1*H*-indol-3-yl)cyclopropyl]-1-ethoxyethane (17) was synthesized using method *A* from alcohol **7** (0.24 g, 1.0 mmol), TEBAC (0.04 g, 0.2 mmol), and EtBr (0.22 g, 2.0 mmol). The reaction mixture was stirred for 5 h at ~20 °C, and then two additional portions of EtBr (0.11 g, 1.0 mmol each) were added with an interval of 2 h (0.44 g of EtBr in all) to complete the reaction (TLC monitoring, the total reaction time was 10 h). After a standard treatment and chromatography, dialkylation product **17** was obtained in 82% yield (0.25 g) as a yellow oil with $[\alpha]_{578}^{25}$ +47.3 (*c* 1.43, EtOAc). UV (EtOH), λ_{max}/nm (ε): 206 (17500), 229 (22900), 286 (6100), 293 (5800). IR ($CHCl_3$), ν/cm^{-1}: 1730, 1465 (C=C_{arom}), 1375, 1350, 1105. ^{1}H NMR ($CDCl_3$—CCl_4), δ: 0.97 (s, 3 H, $H_3C(9)$); 1.14—1.27 (m, 2 H, H(6), H(7α)); 1.15 (t, 3 H, $H_3C(10a)$, *J* = 7.0 Hz); 1.26 (t, 3 H, $H_3C(8a)$, *J* = 7.0 Hz); 1.30 (s, 3 H, $H_3C(10)$); 1.62 (d, 1 H, H(4), *J* = 9.0 Hz); 1.97—2.05 (m, 1 H, H(7β)); 2.33 (s, 3 H, $H_3C(1)$); 3.37 (t, 2 H, $H_2C(8)$, *J* = 7.0 Hz); 3.39 (q, 2 H, $H_2C(9a)$, *J* = 7.0 Hz); 4.02 (q, 2 H, $H_2C(7a)$, *J* = 7.0 Hz); 6.87—6.98 (m, 2 H, H(3a), H(4a)); 7.08 (m, 1 H, H(2a)); 7.41 (m, 1 H, H(5a)). ^{13}C NMR ($CDCl_3$—CCl_4), δ: 11.74 (q, C(1)); 15.24 and 15.30 (both q, C(8a), C(10a)); 17.53 (q, C(9)); 18.03 (s, C(5)); 23.21 (d, C(4)); 24.57 (d, C(6)); 27.30 (t, C(7)); 29.63 (q, C(10)); 37.53 (t, C(7a)); 66.00 (t, C(9a)); 71.05 (t, C(8)); 108.02 (d, C(5a)); 108.50 (s, C(3)); 118.39, 119.91, and 120.33 (all d, C(2a), C(3a), C(4a)); 129.23 (s, C(1a)); 134.06 and 135.61 (both s, C(2), C(6a)). MS, *m/z* (I_{rel} (%)): 299 $[M]^+$ (35), 240 (32), 227 (21), 226 (100), 196 (18), 159 (24), 154 (22), 95 (18), 73 (42), 69 (19), 67 (17), 43 (48), 41 (31), 31 (18), 29 (23), 28 (16). Found: *m/z* 299.2250 $[M]^+$. $C_{20}H_{29}NO$. Calculated: M = 299.2249.

(+)-Methylene-bis{2-methyl-3-[(1*R*,3*S*)-2,2-dimethyl-3-(methoxycarbonyl)cyclopropyl]-1*H*-indol-1-yl} (18) was synthesized using method *A* from indole **4** (0.54 g, 2.0 mmol) and CH_2Br_2 (0.70 g, 4.0 mmol, 0.28 mL). The reaction mixture was vigorously stirred for 10 h at ~20 °C until the starting indole disappeared (TLC monitoring). After a standard treatment and chromatography using a 10% EtOAc—petroleum ether mixture as the eluent, product **18** was obtained in 32% yield (0.18 g) as a viscous light yellow oil with $[\alpha]_{578}^{18}$ +60.9 (*c* 1.61). UV (EtOH), λ_{max}/nm (ε): 227 (52300), 284 (13200), 293 (11800). IR (CCl_4), ν/cm^{-1}: 3050 (C—H_{arom}), 1745 (C=O), 1455 (C=C_{arom}), 1300, 1190, and 1160 (C—O—C), 735 (C—H_{arom}). ^{1}H NMR ($CDCl_3$—CCl_4), δ: 0.87 (s, 3 H, $H_3C(9)$); 1.34 (s, 3 H, $H_3C(10)$); 1.35 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 8.5 Hz, J_3 = 6.0 Hz); 1.70 (dq, 1 H, H(4), J_1 = 9.0 Hz, J_2 = 1.0 Hz); 1.91 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 8.5 Hz); 2.05 (d, 3 H, $H_3C(1)$, *J* = 1.0 Hz); 2.45 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 6.0 Hz); 3.60 (s, 3 H, $H_3C(8a)$); 6.17 (s, 1 H, $H_2C(7a)$); 7.01—7.07 (m, 3 H, H(2a), H(3a), H(4a)); 7.44 (m, 1 H, H(5a)). ^{13}C NMR ($CDCl_3$—CCl_4), δ: 12.30 (q, C(1)); 17.15 (q, C(9)); 18.23 (s, C(5)); 22.27 and 22.45 (both d, C(4), C(6)); 28.89 (q, C(10)); 31.29 (t, C(7)); 51.19 (q, C(8a)); 52.63 (t, C(7a)); 108.63 (d, C(5a)); 110.06 (s, C(3)); 119.65, 119.86, and 121.57 (all d, C(2a), C(3a), C(4a)); 129.15 (s, C(1a)); 135.01 and 136.51 (both s, C(2), C(6a)); 173.55 (s, C(8)). MS, *m/z* (I_{rel} (%)):

554 $[M]^+$ (3), 285 (21), 284 (55), 271 (25), 256 (16), 242 (34), 199 (17), 198 (100), 196 (15), 183 (15), 182 (21), 168 (17), 144 (19), 131 (25), 45 (14). Found: *m/z* 554.3159 $[M]^+$. $C_{35}H_{42}N_2O_4$. Calculated: M = 554.3144.

(+)-[(1*R*,3*S*)-2,2-Dimethyl-3-(1-benzyl-2-methyl-1*H*-indol-3-yl)cyclopropyl]acetic acid (19). A mixture of ester **4** (0.38 g, 1.4 mmol), $PhCH_2Cl$ (1.01 g, 8.0 mmol), and TEBAC (0.02 g) was heated with vigorous stirring to 60 °C. After the ester and TEBAC dissolved completely, a 50% aqueous solution of NaOH (2 mL) was added. The suspension that formed was stirred for 4 h at 70—75 °C until initial ester **4** disappeared (TLC monitoring). The reaction mixture was cooled and extracted with Bu^tOMe (2×15 mL). The aqueous layer was acidified with 10% HCl to pH ~5 and extracted with $CHCl_3$ (3×20 mL). The extract was washed with water (15 mL) and a saturated solution of NaCl and dried with anhydrous Na_2SO_4. After the solvent was removed *in vacuo* and the residue was chromatographed using 10% EtOAc in hexane as the eluent, acid **19** was isolated in 69% yield (0.34 g) as a light yellow oil with $[\alpha]_{578}^{25}$ +44.4 (*c* 1.31). UV (EtOH), λ_{max}/nm (ε): 209 (22600), 227 (22600), 286 (6200). IR (CCl_4), ν/cm^{-1}: 3540 (O—H), 3030 (C—H_{arom}), 1740, 1710 (C=O), 1465 (C=C_{arom}), 785, and 740 (C—H_{arom}). ^1H NMR (acetone-d_6), δ: 1.02 (s, 3 H, $H_3C(9)$); 1.38 (s, 3 H, $H_3C(10)$); 1.40 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 9.0 Hz, J_3 = 6.0 Hz); 1.77 (d, 1 H, H(4), *J* = 9.0 Hz); 2.05 (dd, 1 H, H(7α), J_1 = 18.0 Hz, J_2 = 9.0 Hz); 2.30 (s, 3 H, $H_3C(1)$); 2.68 (dd, 1 H, H(7β), J_1 = 18.0 Hz, J_2 = 6.0 Hz); 5.30 (s, 2 H, $H_2C(7a)$); 6.92—7.21 (m, 8 H, H(2a), H(3a), H(4a), H(9a), H(10a), H(11a)); 7.57—7.61 (m, 1 H, H(5a)); 11.87 (br.s, 1 H, COOH). ^{13}C NMR (acetone-d_6), δ: 11.94 (q, C(1)); 17.47 (q, C(9)); 18.67 (s, C(5)); 23.18 and 23.34 (both d, C(4), C(6)); 29.12 (q, C(10)); 31.91 (t, C(7)); 46.75 (t, C(7a)); 108.62 (s, C(3)); 109.78 (d, C(5a)); 119.52, 120.07, and 121.35 (all d, C(2a), C(3a), C(4a)); 126.67 (two d, C(10a)); 127.73 (d, C(11a)); 129.29 (two d, C(9a)); 129.78 (s, C(1a)); 136.66 and 137.56 (both s, C(2), C(6a)); 139.29 (s, C(8a)); 175.57 (s, C(8)). MS, *m/z* (I_{rel} (%)): 347 $[M]^+$ (15), 289 (19), 288 (85), 221 (6), 92 (9), 91 (100), 65 (8), 28 (7). Found: *m/z* 347.1883 $[M]^+$. $C_{23}H_{25}NO_2$. Calculated: M = 347.1885.

Ethyl (+)-[(1*R*,3*S*)-2,2-dimethyl-3-(2-methyl-1*H*-indol-3-yl)cyclopropyl] acetate (20) was synthesized using method *C* from acid **6** (0.26 g, 1.0 mmol) and EtBr (0.32 g, 3.0 mmol) with stirring for 16 h. After a standard treatment and chromatography, ester **20** was obtained in 88% yield (0.25 g) as a light yellow oil with $[\alpha]_{578}^{26}$ +68.8 (*c* 4.42). UV (EtOH), λ_{max}/nm (ε): 228 (155600), 286 (6800), 294 (6200). IR (CCl_4), ν/cm^{-1}: 3480 (NH_{indole}), 3055 (C—H_{arom}), 1735 (C=O), 1455 (C=C_{arom}), 1170 и 1155 (C—O—C), 725 (C—H_{arom}). ^1H NMR ($CDCl_3$), δ: 0.99 (s, 3 H, $H_3C(9)$); 1.25 (t, 3 H, $H_3C(8a)$, *J* = 7.5 Hz); 1.37 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 8.0 Hz, J_3 = 6.0 Hz); 1.39 (s, 3 H, $H_3C(10)$); 1.74 (dq, 1 H, H(4), J_1 = 8.0 Hz, J_2 = 1.2 Hz); 2.04 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 9.0 Hz); 2.32 (d, 3 H, $H_3C(1)$, *J* = 1.2 Hz); 2.61 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 6.0 Hz); 4.14 (q, 2 H, $H_2C(7a)$, *J* = 7.5 Hz); 6.95—7.13 (m, 3 H, H(2a), H(3a), H(4a)); 7.43 (m, 1 H, H(5a)); 7.82 (br.s, 1 H, NH). ^{13}C NMR ($CDCl_3$), δ: 12.93 (q, C(1)); 14.28 (q, C(8a)); 17.26 (q, C(9)); 18.21 (s, C(5)); 22.43 and 22.55 (both d, C(4), C(6)); 28.96 (q, C(10)); 31.75 (t, C(7)); 59.88 (t, C(7a)); 108.25 (s, C(3)); 109.90 (d, C(5a)); 118.97, 119.35, and 120.89 (all d, C(2a), C(3a), C(4a)); 129.77 (s, C(1a)); 133.39 and 135.57 (both s, C(2), C(6a)); 173.47 (s, C(8)). MS, *m/z* (I_{rel} (%)): 285 $[M]^+$ (34), 199 (16), 198 (100), 196 (11), 183 (10), 182 (16), 168 (12), 167 (8), 144 (14), 131 (27). Found: *m/z* 285.1730 $[M]^+$. $C_{18}H_{23}NO_2$. Calculated: M = 285.1729.

2-Bromoethyl (+)-[(1*R*,3*S*)-2,2-dimethyl-3-(2-methyl-1*H*-indol-3-yl)cyclopropyl] acetate (21) was synthesized using method *C* from acid **6** (0.26 g, 1.0 mmol) and 1,2-dibromoethane (0.56 g, 3.0 mmol). The reaction time was 10 h. After a standard treatment and chromatography, ester **21** was obtained in 30% yield (0.11 g) as a viscous light yellow oil with $[\alpha]_{578}^{29}$ +48.2 (*c* 1.23). UV (EtOH), λ_{max}/nm (ε): 227 (25500), 284 (5900), 291 (5700). IR (CCl_4), ν/cm^{-1}: 3480 (NH_{indole}), 3060 (C—H_{arom}), 1745 (C=O), 1460 (C=C_{arom}), 1150 (C—O—C), 740 (C—H_{arom}). ^1H NMR (acetone-d_6), δ: 0.98 (s, 3 H, $H_3C(9)$); 1.34 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 8.8 Hz, J_3 = 5.8 Hz); 1.35 (s, 3 H, $H_3C(10)$); 1.72 (dq, 1 H, H(4), J_1 = 9.0 Hz, J_2 = 0.8 Hz); 2.04 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 8.8 Hz); 2.37 (d, 3 H, $H_3C(1)$, *J* = 0.8 Hz); 2.70 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 5.8 Hz); 3.59 (t, 2 H, $H_2C(8a)$, *J* = 6.0 Hz); 4.38 (t, 2 H, $H_2C(7a)$, *J* = 6.0 Hz); 6.89—7.01 (m, 2 H, H(3a), H(4a)); 7.23 (m, 1 H, H(2a)); 7.43 (m, 1 H, H(5a)); 9.92 (br.s, 1 H, NH). ^{13}C NMR (acetone-d_6), δ: 13.10 (q, C(1)); 17.48 (q, C(9)); 18.83 (s, C(5)); 23.09 and 23.34 (both d, C(4), C(6)); 29.13 (q, C(10)); 30.33 (t, C(8a)); 32.21 (t, C(7)); 64.51 (t, C(7a)); 107.96 (s, C(3)); 111.07 (d, C(5a)); 119.17, 119.75 and 121.12 (all d, C(2a), C(3a), C(4a)); 130.59 (s, C(1a)); 135.30 and 136.94 (both s, C(2), C(6a)); 173.58 (s, C(8)). MS, *m/z* (I_{rel} (%)): 365 $[M + 2H]^+$ (10), 363 $[M]^+$ (11), 199 (26), 198 (100), 183 (11), 182 (14), 168 (13), 144 (12), 131 (22). Found: *m/z* 363.0851 $[M]^+$. $C_{18}H_{22}BrNO_2$. Calculated: M = 363.0834.

5-Bromoamyl (+)-[(1*R*,3*S*)-2,2-dimethyl-3-(2-methyl-1*H*-indol-3-yl)cyclopropyl] acetate (22) was synthesized using method *C* from acid **6** (0.26 g, 1.0 mmol) and 1,5-dibromopentane (0.69 g, 3.0 mmol) during 32 h. After a standard treatment and chromatography, ester **22** was obtained in 38% yield (0.15 g) as a viscous light yellow oil with $[\alpha]_{578}^{29}$ +50.4 (*c* 2.26). UV (EtOH), λ_{max}/nm (ε): 227 (21900), 283 (6400), 291(5900). IR ($CHCl_3$), ν/cm^{-1}: 3470 (NH_{indole}), 1730 (C=O), 1460 (C=C_{arom}), 1160 (C—O—C). ^1H NMR ($CDCl_3$—CCl_4), δ: 0.93 (s, 3 H, $H_3C(9)$); 1.34 (s, 3 H, $H_3C(10)$); 1.33—1.66 (m, 5 H, H(6), $H_2C(9a)$, $H_2C(10a)$); 1.67 (d, 1 H, H(4), *J* = 9.0 Hz); 1.74—1.81 (m, 2 H, $H_2C(8a)$); 1.94 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 9.0 Hz); 2.24 (s, 3 H, $H_3C(1)$); 2.54 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 5.5 Hz); 3.26 (t, 2 H, $H_2C(11a)$, *J* = 6.8 Hz); 4.00 (t, 2 H, $H_2C(7a)$, *J* = 6.5 Hz); 6.09—7.01 (m, 3 H, H(2a), H(3a), H(4a)); 7.33 (m, 1 H, H(5a)); 7.75 (br.s, 1 H, NH). ^{13}C NMR ($CDCl_3$—CCl_4), δ: 12.91 (q, C(1)); 17.26 (q, C(9)); 18.16 (s, C(5)); 22.36 and 22.54 (both d, C(4), C(6)); 24.60 (t, C(9a)); 27.63 (t, C(8a)); 28.93 (q, C(10)); 31.65 (t, C(11a)); 32.19 (t, C(7)); 32.60 (t, C(10a)); 63.82 (t, C(7a)); 108.09 (s, C(3)); 109.90 (d, C(5a)); 118.93, 119.25, and 120.84 (all d, C(2a), C(3a), C(4a)); 129.71 (s, C(1a)); 133.35 and 135.54 (both s, C(2), C(6a)); 173.36 (s, C(8)). MS, *m/z* (I_{rel} (%)): 407 $[M + 2H]^+$ (10), 405 $[M]^+$ (9), 199 (16), 198 (100), 183 (11), 182 (14), 168 (11), 144 (10), 131 (31), 69 (20), 43 (12), 41 (15), 28 (10). Found: *m/z* 405.1303 $[M]^+$. $C_{21}H_{28}BrNO_2$. Calculated: M = 405.1304.

Benzyl (+)-[(1*R*,3*S*)-2,2-dimethyl-3-(2-methyl-1*H*-indol-3-yl)cyclopropyl] acetate (23) was synthesized using method *C* from acid **6** (0.26 g, 1.0 mmol) and $PhCH_2Cl$ (0.14 g, 1.1 mmol). The reaction time was 12 h. After a standard treatment and chroma-

tography, ester **23** was obtained in 66% yield (0.23 g) as a viscous light yellow oil with $[\alpha]_{578}^{27}$ +50.4 (*c* 2.46). UV (EtOH), λ_{max}/nm (ε): 227 (30900), 284 (6600), 293 (6100). IR (CCl_4), ν/cm^{-1}: 3480 (NH_{indole}), 3070 (C—H_{arom}), 1740 (C=O), 1460 (C=C_{arom}), 1150 (C—O—C), 735 and 695 (C—H_{arom}). ^{1}H NMR (acetone-d_6), δ: 0.94 (s, 3 H, H_3C(9)); 1.32 (s, 3 H, H_3C(10)); 1.38 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 8.8 Hz, J_3 = 5.8 Hz); 1.71 (dq, 1 H, H(4), J_1 = 9.0 Hz, J_2 = 1.2 Hz); 2.05 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 8.8 Hz); 2.34 (d, 3 H, H_3C(1), J = 1.2 Hz); 2.70 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 5.8 Hz); 5.11 (s, 2 H, H_2C(7a)); 6.86—7.01 (m, 2 H, H(3a), H(4a)); 7.23 (m, 1 H, H(2a)); 7.30—7.36 (m, 5 H, H(9a), H(10a), H(11a)); 7.42 (m, 1 H, H(5a)); 9.88 (br.s, 1 H, NH). ^{13}C NMR (acetone-d_6), δ: 13.08 (q, C(1)); 17.48 (q, C(9)); 18.79 (s, C(5)); 23.24 and 23.39 (both d, C(4), C(6)); 29.03 (q, C(10)); 32.39 (t, C(7)); 66.37 (t, C(7a)); 108.00 (s, C(3)); 111.07 (d, C(5a)); 119.19, 119.79, and 121.12 (all d, C(2a), C(3a), C(4a)); 128.74 (d, C(11a)); 128.94 (two d, C(9a)); 129.20 (two d, C(10a)); 130.63 (s, C(1a)); 135.32 (s, C(8a)); 136.96 and 137.58 (both s, C(2), C(6a)); 173.76 (s, C(8)). MS, *m/z* (I_{rel} (%)): 347 [M]$^+$ (30), 257 (11), 256 (63), 199 (17), 198 (100), 196 (12), 183 (12), 182 (17), 171 (12), 170 (87), 168 (16), 144 (13), 131 (12), 91 (37). Found: *m/z* 347.1883 [M]$^+$. $C_{23}H_{25}NO_2$. Calculated: M = 347.1885.

Ethylene glycol (+)-di-[(1*R*,3*S*)-2,2-dimethyl-3-(2-methyl-1*H*-indol-3-yl)cyclopropyl] acetate (24) was synthesized using method *C* from acid **6** (0.26 g, 1.0 mmol) and 1,2-dibromoethane (0.09 g, 0.5 mmol). The reaction time was 40 h. After a standard treatment and chromatography, ester **24** was obtained in 44% yield (0.12 g) as a colorless glassy substance with $[\alpha]_{578}^{25}$ +55.4 (*c* 1.45). UV (EtOH), λ_{max}/nm (ε): 227 (112500), 284 (23100), 291 (21600). IR ($CHCl_3$), ν/cm^{-1}: 3470 (NH_{indole}), 1735 (C=O), 1460 (C=C_{arom}), 1155 (C—O—C), 790, 730, and 670 (C—H_{arom}). ^{1}H NMR ($CDCl_3$), δ: 0.89 (s, 3 H, H_3C(9)); 1.31 (s, 3 H, H_3C(10)); 1.35 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 8.8 Hz, J_3 = 5.8 Hz); 1.68 (dq, 1 H, H(4), J_1 = 9.0 Hz, J_2 = 1.0 Hz); 2.05 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 8.8 Hz); 2.26 (d, 3 H, H_3C(1), J = 1.0 Hz); 2.60 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 5.8 Hz); 4.21 (s, 2 H, H_2C(7a)); 6.95—7.10 (m, 2 H, H(3a), H(4a)); 7.16—7.22 (m, 1 H, H(2a)); 7.39—7.45 (m, 1 H, H(5a)); 7.66 (br.s, 1 H, NH). ^{13}C NMR ($CDCl_3$), δ: 12.81 (q, C(1)); 17.01 (q, C(9)); 18.16 (s, C(5)); 22.07 and 22.34 (both d, C(4), C(6)); 28.65 (q, C(10)); 31.51 (t, C(7)); 61.92 (t, C(7a)); 108.09 (s, C(3)); 109.91 (d, C(5a)); 118.85, 119.26, and 120.76 (all d, C(2a), C(3a), C(4a)); 129.65 (s, C(1a)); 133.86 and 135.37 (both s, C(2), C(6a)); 173.65 (s, C(8)). MS, *m/z* (I_{rel} (%)): 540 [M]$^+$ (5), 199 (16), 198 (100), 183 (8), 182 (9), 168 (8), 144 (8), 131 (11), 28 (8). Found: *m/z* 540.3001 [M]$^+$. $C_{34}H_{40}N_2O_4$. Calculated: M = 540.2988.

1,5-Pentanediol (+)-di-[(1*R*,3*S*)-2,2-dimethyl-3-(2-methyl-1*H*-indol-3-yl)cyclopropyl] acetate (25) was synthesized using method *C* from acid **6** (0.26 g, 1.0 mmol) and 1,5-dibromopentane (0.12 g, 0.5 mmol). The reaction time was 32 h. After a standard treatment and chromatography, ester **25** was obtained in 76% yield (0.22 g) as a light yellow oil with $[\alpha]_{578}^{25}$ +71.8 (*c* 1.81). UV (EtOH), λ_{max}/nm (ε): 209 (22400), 227 (23700), 284 (8700), 291 (8000). IR ($CHCl_3$), ν/cm^{-1}: 3470 (NH_{indole}), 1725 (C=O), 1460 (C=C_{arom}), 1295, 1175 (C—O—C). ^{1}H NMR ($CDCl_3$—CCl_4), δ: 0.98 (s, 3 H, H_3C(9)); 1.30—1.45 (m, 2 H, H(6), H_2C(9a)); 1.36 (s, 6 H, H_3C(10)); 1.60 (m, 2 H, H_2C(8a)); 1.72 (d, 1 H, H(4), J = 9.0 Hz); 2.02 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 8.5 Hz); 2.28 (s, 3 H, H_3C(1)); 2.59 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 5.8 Hz); 4.05 (m, 2 H, H_2C(7a)); 6.99—7.08 (m, 3 H, H(2a), H(3a), H(4a)); 7.43 (d, 1 H, H(5a), J = 7.5 Hz); 7.90 (br.s, 1 H, NH). ^{13}C NMR ($CDCl_3$—CCl_4), δ: 12.84 (q, C(1)); 17.23 (q, C(9)); 18.11 (s, C(5)); 22.30 and 22.48 (both d, C(4), C(6)); 22.52 (t, C(9a)); 28.29 (t, C(8a)); 28.90 (q, C(10)); 31.61 (t, C(7)); 63.79 (t, C(7a)); 107.98 (s, C(3)); 109.95 (d, C(5a)); 118.87, 119.25, and 120.78 (all d, C(2a), C(3a), C(4a)); 129.68 (s, C(1a)); 133.43 and 135.52 (both s, C(2), C(6a)); 173.54 (s, C(8)). MS, *m/z* (I_{rel} (%)): 582 [M]$^+$ (4), 199 (16), 198 (100), 182 (7), 168 (6), 144 (8), 131 (6), 28 (7). Found: *m/z* 582.3459 [M]$^+$. $C_{37}H_{46}N_2O_4$. Calculated: M = 582.3457.

Benzyl (+)-[(1*R*,3*S*)-2,2-dimethyl-3-(1-benzyl-2-methyl-1*H*-indol-3-yl)cyclopropyl] acetate (26). A mixture of acid **6** (0.26 g, 1.0 mmol), $PhCH_2Cl$ (0.51 g, 4.0 mmol), and TEBAC (0.01 g) was heated with vigorous stirring to 60 °C. After the acid and TEBAC were completely dissolved, a 50% aqueous solution of NaOH (2 mL) was added. The suspension that formed was stirred for 6 h at 60—65 °C until the initial acid disappeared (TLC monitoring), during which the mixture was rarefied. The reaction mixture was cooled and extracted with Bu^{t}OMe (3×20 mL). The combined extract was washed with water (15 mL) and a saturated solution of NaCl and dried with anhydrous Na_2SO_4. After the solvent was removed *in vacuo* and the residue was chromatographed using 10% EtOAc in hexane as the eluent, indolo ester **26** was isolated in 73% yield (0.32 g) as a light yellow oil with $[\alpha]_{578}^{23}$ +35.8 (*c* 1.96). UV (EtOH), λ_{max}/nm (ε): 210 (26200), 226 (23100), 286 (6400). IR (CCl_4), ν/cm^{-1}: 3030 (C—H_{arom}), 1740 (C=O), 1465 (C=C_{arom}), 1455, 1155 (C—O—C), 805 (C—H_{arom}). ^{1}H NMR ($CDCl_3$—CCl_4), δ: 0.92 (s, 3 H, H_3C(9)); 1.32 (s, 3 H, H_3C(10)); 1.34 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 8.5 Hz, J_3 = 6.0 Hz); 1.75 (d, 1 H, H(4), J = 9.0 Hz); 2.03 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 8.5 Hz); 2.20 (s, 3 H, H_3C(1)); 2.61 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 6.0 Hz); 5.03 (s, 2 H, H_2C(12a)); 5.19 (s, 2 H, H_2C(7a)); 6.81—7.28 (m, 13 H, H(2a), H(3a), H(4a), H(9a), H(10a), H(11a), H(14a), H(15a), H(16a)); 7.40—7.44 (m, 1 H, H(5a)). ^{13}C NMR ($CDCl_3$—CCl_4), δ: 11.73 (q, C(1)); 17.37 (q, C(9)); 18.33 (s, C(5)); 22.52 and 22.94 (both d, C(4), C(6)); 29.00 (q, C(10)); 31.61 (t, C(7)); 46.49 (t, C(7a)); 71.92 (t, C(12a)); 108.29 (s, C(3)); 108.71 (d, C(5a)); 119.11, 119.57, and 121.00 (all d, C(2a), C(3a), C(4a)); 125.79, 128.32, 128.36, 128.74 (all two d each, C(9a), C(10a), C(14a), C(15a)); 127.60, and 127.98 (both d, C(11a), C(16a)); 128.95 (s, C(1a)); 135.23 and 136.76 (both s, C(2), C(6a)); 136.26 (s, C(8a)); 137.95 (s, C(13a)); 172.96 (s, C(8)). MS, *m/z* (I_{rel} (%)): 437 [M]$^+$ (8), 346 (7), 289 (17), 288 (77), 260 (9), 234 (5), 221 (8), 182 (5), 92 (9), 91 (100), 65 (7), 28 (5). Found: *m/z* 437.2357 [M]$^+$. $C_{30}H_{31}NO_2$. Calculated: M = 437.2355.

(+)-{(1*R*,3*S*)-2,2-Dimethyl-3-[2-methyl-1-(toluene-4-sulfonyl)-1*H*-indol-3-yl]cyclopropyl}acetonitrile (27) was obtained using method *A* from indole **2** (0.48 g, 2.0 mmol) and TsCl (0.57 g, 3.0 mmol). The reaction was carried out at ~20 °C for 1 h. After a standard treatment and chromatography, product **27** was obtained in 95% yield (0.74 g) as a light yellow oil with $[\alpha]_{578}^{30}$ +61.3 (*c* 2.77). UV (EtOH), λ_{max}/nm (ε): 221 (22700), 255 (13500). IR (CCl_4), ν/cm^{-1}: 3080 (C—H_{arom}), 2250 (C≡N), 1575, 1455 (C=H_{arom}), 1390, 1240, 1185 (S=O), 800 (C—H_{arom}). ^{1}H NMR ($CDCl_3$—CCl_4), δ: 0.91 (s, 3 H, H_3C(9)); 1.32—1.46 (m, 2 H, H(6), H(7β)); 1.34 (s, 3 H, H_3C(10)); 1.54 (dd, 1 H, H(7α), J_1 = 17.0 Hz, J_2 = 9.2 Hz); 1.65 (dq, 1 H, H(4), J_1 =

9.7 Hz, J_2 = 1.2 Hz); 2.32 (d, 3 H, $H_3C(1)$, J = 1.2 Hz); 2.48 (s, 3 H, $H_3C(11a)$); 7.12—7.21 (m, 5 H, H(2a), H(3a), H(4a), H(9a)); 7.53 (d, 1 H, H(5a), J = 8.0 Hz); 8.15 (m, 2 H, H(8a)). ^{13}C NMR ($CDCl_3$—CCl_4), δ: 14.19 (t, C(7)); 14.73 (q, C(1)); 16.25 (q, C(9)); 18.67 (s, C(5)); 21.39 (q, C(11a)); 22.15 and 22.32 (both d, C(4), C(6)); 28.18 (q, C(10)); 115.13 (d, C(5a)); 116.46 (s, C(3)); 118.74 (s, C(8)); 118.97, 123.45, and 124.26 (all d, C(2a), C(3a), C(4a)); 126.10 (two d, C(9a)); 129.54 (two d, C(8a)); 130.77 (s, C(1a)); 136.08 and 137.00 (both s, C(2), C(6a)); 136.47 (s, C(10a)); 144.48 (s, C(7a)). MS, m/z (I_{rel} (%)): 392 $[M]^+$ (21), 353 (25), 352 (100), 197 (34), 196 (31), 182 (34), 181 (11), 155 (14), 91 (29). Found: m/z 392.1553 $[M]^+$. $C_{23}H_{24}N_2O_2S$. Calculated: M = 392.1558.

(+)-{(1*R*,3*S*)-2,2-Dimethyl-3-[2-methyl-1-(4-bromobenzenesulfonyl)-1*H*-indol-3-yl]cyclopropyl}acetonitrile (28) was obtained using method *A* from indole **2** (0.48 g, 2.0 mmol) and 4-$BrC_6H_4SO_2Cl$ (0.77 g, 3.0 mmol). The reaction was carried out at ~20 °C for 1 h. After a standard treatment and chromatography, product **28** was obtained in 95% yield (0.87 g) as a light yellow oil with $[\alpha]_{578}^{29}$ +51.0 (*c* 2.55). UV (EtOH), λ_{max}/nm (ε): 224 (23000), 256 (16800). IR (CCl_4), ν/cm^{-1}: 3070 (C—H_{arom}), 2250 (C≡N), 1575, 1455 (C=C_{arom}), 1390, 1185 (S=O), 1090, 1070. ^{1}H NMR ($CDCl_3$—CCl_4), δ: 0.94 (s, 3 H, $H_3C(9)$); 1.25 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 8.4 Hz, J_3 = 5.8 Hz); 1.34 (s, 3 H, $H_3C(10)$); 1.65 (dq, 1 H, H(4), J_1 = 8.4 Hz, J_2 = 0.8 Hz); 1.66 (dd, 1 H, H(7α), J_1 = 18.0 Hz, J_2 = 9.0 Hz); 2.37 (dd, 1 H, H(7β), J_1 = 18.0 Hz, J_2 = 5.8 Hz); 2.48 (d, 3 H, $H_3C(1)$, J = 0.8 Hz); 7.16—7.33 (m, 3 H, H(2a), H(3a), H(4a)); 7.46—7.56 (m, 4 H, H(8a), H(9a)); ~8.09 (m, 1 H, H(5a)). ^{13}C NMR ($CDCl_3$—CCl_4), δ: 14.69 (q, C(1)); 14.92 (t, C(7)); 16.34 (q, C(9)); 18.70 (s, C(5)); 22.25 and 22.38 (both d, C(4), C(6)); 28.20 (q, C(10)); 114.77 (d, C(5a)); 116.55 (s, C(3)); 118.71 (s, C(8)); 119.22, 123.70, and 124.51 (all d, C(2a), C(3a) and C(4a)); 127.60 (two d, C(8a)); 128.78 (s, C(10a)); 130.64 (s, C(1a)); 132.39 (two d, C(9a)); 136.59 and 137.94 (both s, C(2), C(6a)); 136.26 (s, C(7a)). MS, m/z (I_{rel} (%)): 458 $[M + 2 H]^+$ (22), 456 $[M]^+$ (20), 419 (22), 418 (100), 417 (21), 416 (96), 237 (12), 198 (12), 197 (69), 196 (57), 182 (68), 181 (19), 167 (13), 141 (12), 115 (12). Found: m/z 456.0514 $[M]^+$. $C_{22}H_{21}BrN_2O_2S$. Calculated: M = 456.0508.

(+)-[(1*R*,3*S*)-2,2-Dimethyl-3-(1-formyl-2-methyl-1*H*-indol-3-yl)cyclopropyl]acetonitrile (29). A solution of indole **2** (0.48 g, 2.0 mmol) in DMF (2 mL) was added dropwise to a mixture of $POCl_3$ (0.5 mL) and DMF (1 mL) with cooling to 0 °C and stirring and stored for 3 days at ~20 °C. The mixture was diluted with water (10 mL), neutralized with an aqueous solution of Na_2CO_3 to pH 8 (0.5 mol L^{-1}, ~50 mL), and extracted with Bu^{t}OMe (3×10 mL). The extract was washed with a saturated solution of NaCl and dried with anhydrous Na_2SO_4. After the solvent was removed *in vacuo*, a crystalline substance (0.45 g) was obtained, whose recrystallization from EtOH gave product **29** in 75% yield (0.40 g) with m.p. 152—155 °C (from EtOH), $[\alpha]_{578}^{25}$ +94.3 (*c* 1.38, EtOAc). UV (EtOH), λ_{max}/nm (ε): 205 (20300), 247 (15300), 300 (4500). IR (KBr), ν/cm^{-1}: 3000 (C—H_{arom}), 2240 (C≡N), 1710 (C=O), 1690, 1610, 1450 (C=C_{arom}), 1440, 1345, 1325, 1175, 745 (C—H_{arom}). ^{1}H NMR ($(CD_3)_2SO$), δ: 0.96 (s, 3 H, $H_3C(9)$); 1.34 (s, 3 H, $H_3C(10)$); 1.38 (ddd, 1 H, H(6), J_1 = 9.5 Hz, J_2 = 9.0 Hz, J_3 = 6.0 Hz); 1.69 (dq, 1 H, H(4), J_1 = 9.0 Hz, J_2 = 1.5 Hz); 2.03 (dd, 1 H, H(7α), J_1 = 18.0 Hz, J_2 = 9.5 Hz); 2.50 (d, 3 H, $H_3C(1)$, J = 1.5 Hz); 2.81 (dd, 1 H, H(7β), J_1 = 18.0 Hz, J_2 = 6.0 Hz); 7.24—7.26 (m, 2 H, H(3a), H(4a)); 7.44—7.47 (m, 1 H, H(2a)); 8.21 (br.s, 1 H, H(5a)); 9.31 (br.s, 1 H, H(7a)). ^{13}C NMR ($(CD_3)_2SO$), δ: 15.75 (q, C(1)); 18.31 (t, C(7)); 20.19 (q, C(9)); 21.98 (s, C(5)); 25.40 and 26.12 (both d, C(4), C(6)); 31.75 (q, C(10)); 118.22 (s, C(3)); 123.21 (d, C(5a)); 124.48 (s, C(8)); 127.67 (both d, C(3a), C(4a)); 128.00 (d, C(2a)); 134.70 (s, C(1a)); 138.26 and 139.35 (both s, C(2), C(6a)); 164.25 (d, C(7a)). MS, m/z (I_{rel} (%)): 266 $[M]^+$ (36), 227 (16), 226 (100), 223 (8), 197 (41), 183 (18), 182 (21), 168 (20), 167 (11), 144 (8). Found: m/z 266.1416 $[M]^+$. $C_{17}H_{18}N_2O$. Calculated: M = 266.1419.

(+)-[(1*R*,3*S*)-2,2-Dimethyl-3-(1-methyl-2-(2-oxoethyl)-1*H*-indol-3-yl)cyclopropyl]acetonitrile (30). A solution of indole **8** (0.25 g, 1.0 mmol) in DMF (2 mL) was added dropwise with cooling to 0 °C to a mixture of DMF (1 mL) and $POCl_3$ (1.5 mL, 16.3 mmol). The mixture was stirred at ~20 °C for 5—6 h until the initial indole disappeared (TLC monitoring). The reaction mixture was diluted with water, neutralized with an aqueous solution of Na_2CO_3 (0.5 mol L^{-1}) to pH ~ 8, and extracted with Bu^{t}OMe (3×15 mL). The combined ethereal extract was washed with a saturated solution of NaCl and dried with anhydrous $MgSO_4$. The solvent was removed *in vacuo*, and a crystalline substance that obtained was recrystallized from an EtOAc—hexane mixture. Aldehyde **30** was isolated in 75% yield (0.21 g) with m.p. 75—77 °C (from EtOAc—hexane), $[\alpha]_{578}^{25}$ +47.6 (*c* 1.43, EtOAc). UV (EtOH), λ_{max}/nm (ε): 228 (33800), 287 (7200), 294 (7100). IR (KBr), ν/cm^{-1}: 3050 (C—H_{arom}), 2725 (C—$H_{aldehyde}$), 2240 (C≡N), 1720 (C=O), 1700, 1465 (C=C_{arom}), 1350, 740, and 700 (C—H_{arom}). ^{1}H NMR ($CDCl_3$), δ: 1.07 (s, 3 H, $H_3C(9)$); 1.37 (s, 3 H, $H_3C(10)$); 1.38 (ddd, 1 H, H(6), J_1 = 9.0 Hz, J_2 = 8.8 Hz, J_3 = 6.0 Hz); 1.86 (d, 1 H, H(4), J_1 = 8.8 Hz); 1.91 (dd, 1 H, H(7α), J_1 = 17.5 Hz, J_2 = 9.0 Hz); 2.65 (dd, 1 H, H(7β), J_1 = 17.5 Hz, J_2 = 6.0 Hz); 3.59 (s, 3 H, $H_3C(8a)$); 3.90 (m, 2 H, $H_2C(1)$); 7.05—7.26 (m, 3 H, H(2a), H(3a), H(4a)); 7.52 (m, 1 H, H(5a)); 9.31 (t, 1 H, H(7a), J = 1.8 Hz). ^{13}C NMR ($CDCl_3$), δ: 14.96 (t, C(7)); 16.73 (q, C(9)); 18.72 (s, C(5)); 28.23 (q, C(10)); 22.48 and 22.59 (both d, C(4), C(6)); 30.06 (q, C(8a)); 41.19 (t, C(1)); 108.83 (s, C(3)); 109.06 (d, C(5a)); 119.31, 119.37, and 121.87 (all d, C(2a), C(3a), C(4a)); 119.78 (s, C(8)); 127.61 (s, C(1a)); 130.35 (s, C(2)); 137.38 (s, C(6a)); 196.60 (d, C(7a)). MS, m/z (I_{rel} (%)): 280 $[M]^+$ (26), 241 (18), 240 (100), 212 (16), 197 (11), 196 (33), 184 (13), 182 (13), 181 (14). Found: m/z 280.1575 $[M]^+$. $C_{18}H_{20}N_2O$. Calculated: M = 280.1576.

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