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Preparation of Alkyl-Substituted Indoles in the Benzene Portion. Part 6.[1] Synthetic Procedure for 4-, 5-, 6-, or 7-Alkoxy- and Hydroxyindole Derivatives

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A novel method for the preparation of indole derivatives that are alkoxy- and hydroxy-substituted in the benzene portion of the indole nucleus is described. The acid-induced cyclization reaction of (arylsulfonyl)pyrrole derivatives (4a, 4b, 5b, and 5a) in the presence of an appropriate alcohol gave 4-, 5-, 6-, and 7-alkoxyindole derivatives (13 and 28), respectively, where the alkoxy group was originated from the alcohol employed. As an application of the present method, a short and efficient synthesis of two dopamine agonists (34 and 44) was attained by treating appropriately functionalized pyrrole derivatives (38 and 41) with an acid in the presence of 1,3-propanediol, followed by deprotection of alkoxy function, and subsequent reduction with lithium aluminum hydride. A reaction mechanism is also suggested for the formation of an unusual product, 4-[2-(dipropylamino)-1-hydroxyethyl]-6-hydroxyindole (46) in the reduction of *N,N*-dipropyl-(6-hydroxy-1-phenylsulfonyl)indole-4-acetamide (40).

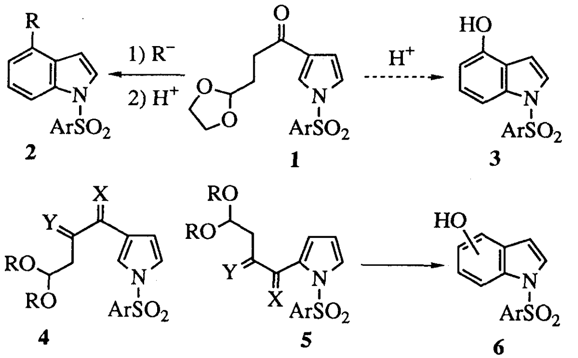
Keywords indole synthesis; acid-induced indole cyclization; alkoxyindole; hydroxyindole; dopamine agonist

Indole derivatives having alkoxy groups in the benzene portion are widespread in nature and in synthetic medicines, and many of them possess remarkable biological activities.[2] It has been reported that some of the indole alkaloid derivatives are metabolically hydroxylated in the 6-position (indole numbering); for example, lergotrile (a dopaminergic ergoline derivative) is converted metabolically into 13-hydroxylergotrile with the hydroxy group in the 6-position of the indole ring, which is more active both *in vitro* and *in vivo* than lergotrile itself.[3a] This strongly suggests that the oxygen function in the benzene portion of the indole derivatives plays a significant role in expression of biological activities.

The well-known methods for the synthesis of alkoxy- and hydroxyindoles are based on the Fischer, Reissert, Bischler, Nenitzescu, and Leimgruber–Batcho procedures, which are classical for construction of the indole nucleus.[2] In addition, other methods have been reported using nitro-substituted indolines,[4a] 4-oxotetrahydroindoles,[4b–d] and α-anilinoacetaldehyde derivatives[4e,f] as synthetic intermediates. Some of them, however, have the limitation of poor regioselectivity, providing isomerically impure products. To improve this selectivity, we searched for a new method for synthesizing alkoxy-substituted indole derivatives having their alkoxy groups in the benzene portion of the indole nucleus.

In the preceding paper, we reported that a pyrrole derivative, 1-[1-(arylsulfonyl)-3-pyrrolyl]-3-(1,3-dioxolan-2-yl)-1-propanone (**1**) is a good common precursor for the synthesis of 4-alkyl-1-(arylsulfonyl)indoles (**2**) (Chart 1). If **1** can be directly cyclized to an indole derivative by treatment with an acid, this operation would provide 1-arylsulfonyl-4-hydroxyindoles (**3**). This might be extended to a general scheme for conversion of pyrrole derivatives (**4a** = **1**, **4b**, **5a**, and **5b**) into 4,-, 5-, 6-, and 7-hydroxyindole derivatives (**6**). This paper treats the realization of this plan as well as an application of the newly established method to the synthesis of a potent dopaminergic agent, 4-[2-(dipropylamino)-ethyl]-6-hydroxyindole (**34**),[3)] which carries both alkyl and hydroxy groups in the benzene portion of the indole ring.

Synthesis of 4-Alkoxyindole Derivatives Simple treatment of **7a** with an acid gave us a clue for a new reaction. When **7a** was heated in benzene in the presence of a catalytic amount of *p*-toluenesulfonic acid, an indole derivative (**8a**) having a 2-hydroxyethoxy function was obtained in 45% yield (Chart 2). This substituent at the 4-position originates from the ethylene acetal moiety in **7a**, and intramolecular



a: X = O; Y = H, H b: X = H, H; Y = O

Chart 1

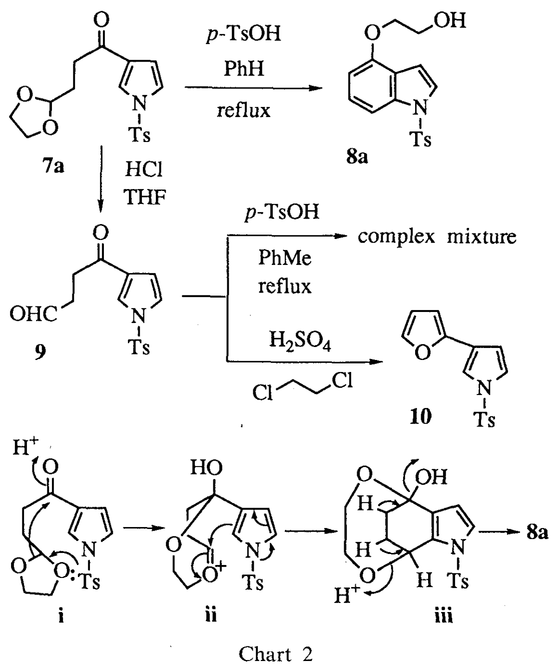
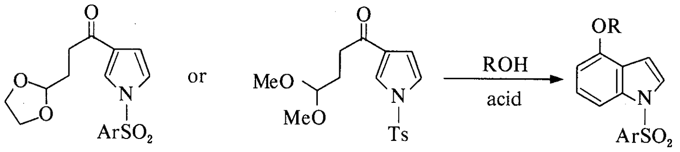
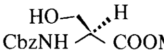


Chart 2

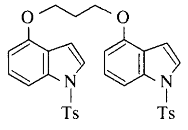
TABLE I. Formation of 4-Alkoxyindole Derivatives (**13**) from **7a**, **b** and **12**[a)]



7a: Ar = *p*-tolyl
7b: Ar = phenyl
12
13

Run	Starting material	ROH (mol eq)	Acid (mol eq)	Solvent	Time (h)	Product (yield %) R in **13**
1	**7b**	$HO(CH_2)_2OH$ (10)	*p*-TsOH (0.2)	PhH	8	$-CH_2CH_2OH$ (**8b**) (90)
2	**12**	MeOH[b)]	H_2SO_4 (1)	CH_2Cl_2	14	–Me (82)
3	**7a**	$PhCH_2OH$ (34)	*p*-TsOH (0.2)	PhMe	5	$-CH_2Ph$(54); **8a** (4)
4	**7b**	$PhCH_2OH$ (66)	*p*-TsOH (0.25)	PhMe	5	$-CH_2Ph$ (42)
5	**7a**	$HO(CH_2)_3OH$ (26)	*p*-TsOH (0.2)	PhMe	6	$-(CH_2)_3OH$ (**14**) (93)
6	**12**	$HO(CH_2)_3OH$ (8)	H_2SO_4 (0.5)	$Cl(CH_2)_2Cl$	4	$-(CH_2)_3OH$ (90); **15** (3.5)
7	**12**	$HO(CH_2)_2OMe$ (30)	H_2SO_4 (0.5)	$Cl(CH_2)_2Cl$	2	$-(CH_2)_2OMe$ (66)
8	**7b**	$HS(CH_2)_2OH$ (24)	*p*-TsOH (0.3)	PhMe	2	**16** (21)
9	**7b**	 (8)	H_2SO_4 (0.5)	$Cl(CH_2)_2Cl$	4	**17** (26); **8b** (27.5)

a) All reactions were carried out under reflux using a Dean-Stark apparatus. *b*) Large excess.



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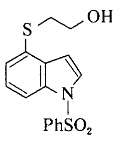

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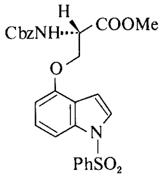

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rearrangement of the acetal group probably takes place as shown in the scheme (**i**→**ii**), where the electron-rich pyrrole group participates in an intermediary oxonium cation to form a tetrahydroindole species (**ii**→**iii**), whose aromatization produces a 4-alkoxyindole derivative (**8a**). Contrary to the above result, the ketoaldehyde derivative (**9**) readily available from **7a** in 98% yield, afforded only an intractable mixture even under the forcing conditions of refluxing in toluene with *p*-toluenesulfonic acid. Treatment of **9** with sulfuric acid in dichloroethane provided a reaction product in 10% yield, but it was a pyrrolylfuran derivative (**10**), which was formed by an acid-catalyzed condensation at the 4-oxobutanal side chain. Therefore, the existence of an alcohol derived from the acetal function seemed to be essential to the indole cyclization reaction. In order to increase the effect of an alcohol in the reaction mixture, ethylene glycol was added to the above reaction mixture. Yield was dramatically enhanced and formation of **8b** was achieved in 90% yield from **7b** (run 1, Table I).

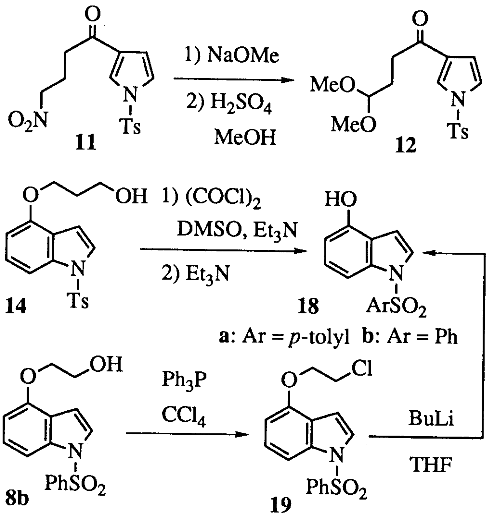


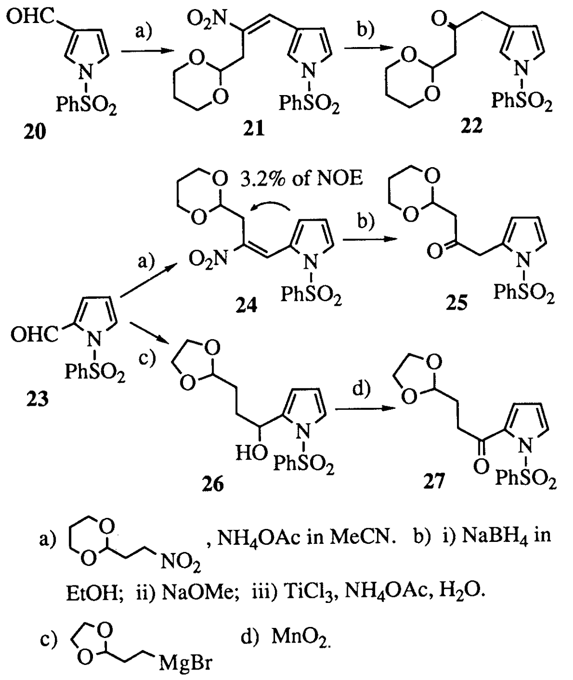
Chart 3

The reaction was extended to the synthesis of a variety of 4-alkoxy-1-(arylsulfonyl)indole derivatives (**13**) (Table I), when **7a** and **7b** were heated with various kinds of alcohols in benzene and toluene or dichloromethane and dichloroethane in the presence of *p*-toluenesulfonic acid or sulfuric acid. The dimethyl acetal derivative (**12**) was readily obtained from **11**[1)] (Chart 3) and was a good starting material for this purpose. Use of an excess amount of alcohols was necessary so as to achieve preferential introduction of the utilized alcohol into the 4-position of the indole compounds (**13**) as observed in run 4, compared with the formation of a by-product (**8a**) in run 3. Generally diols afforded superior results to mono-alcohols, and bifunctional substrates such as 2-mercaptoethanol (run 8) and *N*-benzyloxycarbonyl-L-serine methyl ester (run 9) produced sulfur-substituted (**16**) and oxygen-substituted indole compounds (**17**), respectively, in modest yields.

1-(Arylsulfonyl)-4-hydroxyindole derivatives (**18a, b**)[4d)] were readily obtained from either **14** or **8b** by removal of the 3-hydroxypropyl or 2-hydroxyethyl moiety in the form of acrolein or ethylene (Chart 3). Thus, Swern oxidation of **14**, followed by treatment with triethylamine afforded **18a** in 92% yield, whereas a prior conversion of **8b** to **19** was effected with triphenylphosphine in carbon tetrachloride in 93% yield, and subsequent treatment of **19** with butyllithium furnished **18b** in 79% yield. As the ketoacetal compounds (**7a**, **b** and **12**) were prepared from 1-(arylsulfonyl)pyrrole in two steps by way of the nitro compound (**11**),[1] the present finding constitutes a very short (4 or 5 steps) synthetic method for 1-(arylsulfonyl)-4-hydroxyindoles (**18a, b**) starting from 1-(arylsulfonyl)pyrrole.

Synthesis of 5-, 6-, and 7-Alkoxyindole Derivatives Application of this method for the preparation of 5- and 6-alkoxyindole derivatives necessitated a short and preparative pathway for obtaining precursor molecules (**4b** and **5b**). This was readily achieved by a two-step procedure as shown in Chart 4 for the example of keto-dioxanyl compounds (**22** and **25**) from 3- and 2-formyl-1-(phenylsulfonyl)pyrroles (**20**[1,5] and **23**[6,7]). The aldehydes (**20** and **23**) were condensed with 2-(2-nitroethyl)-1,3-dioxane in the presence of ammonium acetate to give **21** and **24** in 94% and 86% yields. The geometrical structure of **24** was determined to be *E*-form by nuclear Overhauser effect (NOE) analysis (Chart 4). These compounds (**21** and **24**) were then reduced with sodium borohydride in ethanol, and the reaction mixture was treated directly with sodium methoxide and titanium trichloride[8] successively to produce **22** and **25** in 83% and 90% yields, respectively. The latter two operations correspond to the modified Nef reaction.[9] For the preparation of 7-alkoxyindole derivatives, **27** was obtained from **23** by Grignard reaction (**26**, 97% yield) and manganese oxide oxidation (81% yield).

The acid-catalyzed alkoxyindole formation was carried out as shown in Table II. In the cases of **22** and **25**, simple warming in aqueous dimethoxyethane containing 3% hydrochloric acid gave 5- and 6-hydroxy-1-(phenylsulfonyl)-indoles in 93% and 80% yields (runs 1, 3). This tendency of ready cyclization to hydroxyindoles made it difficult to prepare 6-methoxyindole derivatives in the previous fashion, and refluxing of **25** in 6% sulfuric acid–containing methanol afforded the 6-hydroxy derivative in 44% yield in addition to the 6-methoxyindole compound[10] formed in 51% yield (run 5). To overcome this difficulty, excess



a) , NH_4OAc in MeCN. b) i) $NaBH_4$ in EtOH; ii) NaOMe; iii) $TiCl_3$, NH_4OAc, H_2O.
c) d) MnO_2.

Chart 4

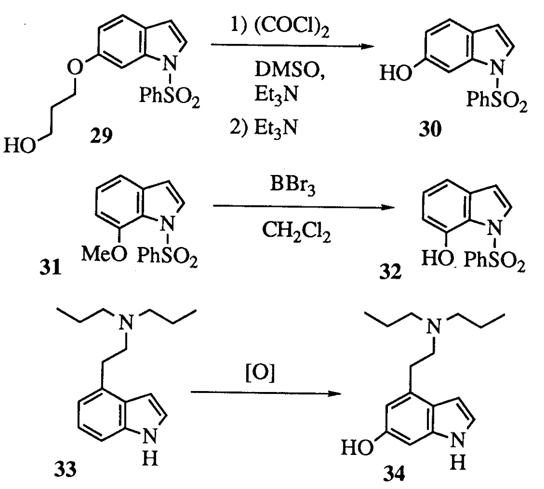
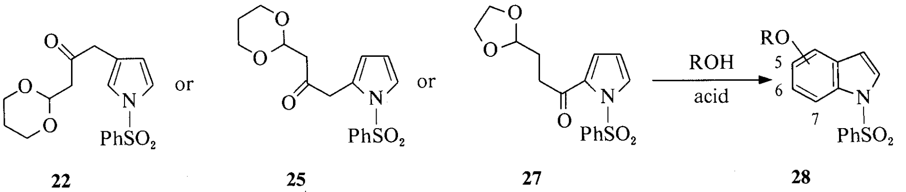


Chart 5

Table II. Formation of 5-, 6-, and 7-Alkoxyindole Derivatives (**28**) from **22**, **25** and **27**



Run	Starting material	Reaction conditions[a]	**28** –OR	Yield (%)
1	**22**	3% HCl in DME–H_2O, 50 °C, 6.5 h	5-OH	93
2	**22**	*p*-TsOH (0.4), $CH(OMe)_3$, MeOH, reflux, 1 h	5-OMe	89
3	**25**	3% HCl in DME–H_2O, 50 °C, 9 h	6-OH (**30**)	80
4	**25**	*p*-TsOH (0.4), $CH(OMe)_3$, MeOH, reflux, 1.5 h	6-OMe	96
5	**25**	6% H_2SO_4 in MeOH, reflux, 1 h	6-OMe	51
			+**30**	44
6	**25**	$HO(CH_2)_3OH$ (8), H_2SO_4 (0.5), $Cl(CH_2)_2Cl$, reflux, 1.5 h	6-$O(CH_2)_3OH$ (**29**)	90
7	**27**	6% H_2SO_4 in MeOH, $CH(OMe)_3$, reflux, 3.5 h	7-OMe (**31**)	69
8	**27**	*p*-TsOH (1.6), $HO(CH_2)_2OH$ (42), PhMe, reflux, 65 h	7-$O(CH_2)_2OH$	31

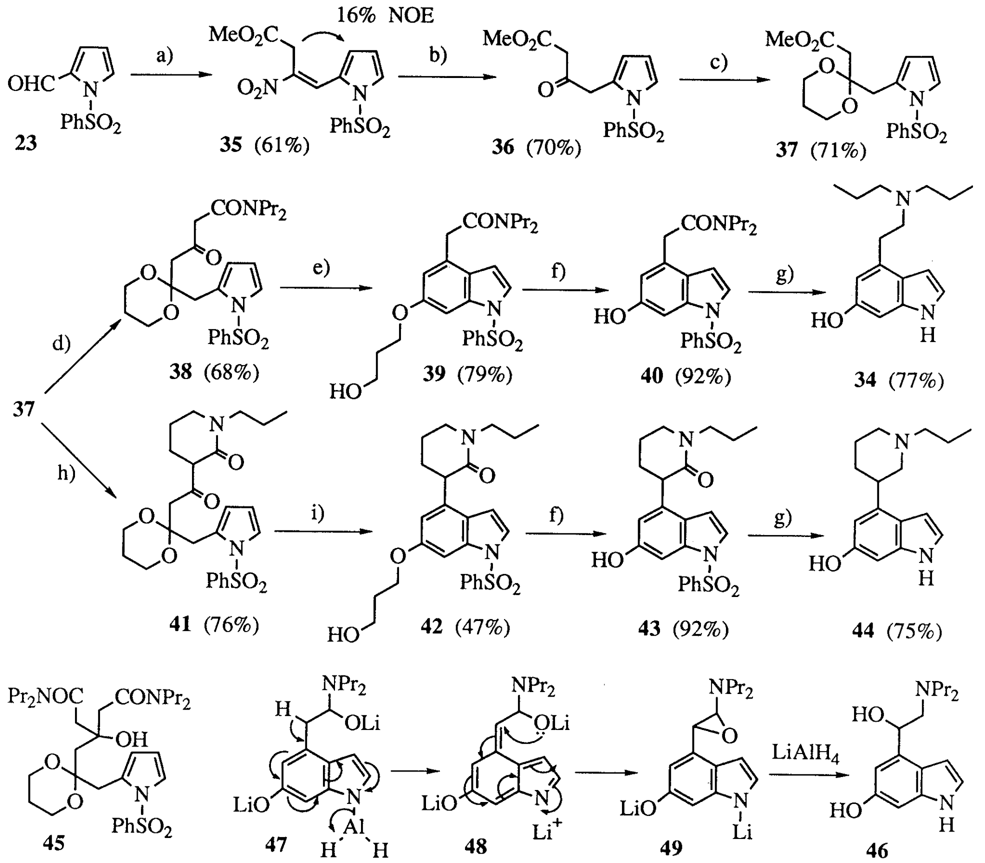
a) Number in parentheses designates molar equivalent amount.

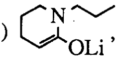
trimethyl orthoformate was used as an additive and heating in methanol in the presence of *p*-toluenesulfonic acid or sulfuric acid smoothly produced the 5-,$^{10)}$ 6-, and 7-methoxyindole derivatives$^{11)}$ in good to excellent yields (runs 2, 4, 7). The presence of 1,3-propanediol afforded in 90% yield 6-(3-hydroxypropyloxy)-1-(phenylsulfonyl)indole (**29**) (run 6), which was converted to the 6-hydroxy derivative (**30**) as above in 88% yield (Chart 5). Direct preparation of 7-hydroxy-1-(phenylsulfonyl)indole (**32**) was hardly possible by this procedure. Ether cleavage of the methoxy group of **31** with boron tribromide proceeded sluggishly to afford **32** in only 23% yield.

Synthesis of 4-[2-(Dipropylamino)ethyl]-6-hydroxyindole (34) and Its Analogue (44) In the preceding paper, we reported a short synthesis of a dopaminergic agent, 4-[2-(dipropylamino)ethyl]indole (**33**) (Chart 5). Concerning its biological activities, it is speculated that the agent (**33**) may undergo metabolic hydroxylation *in vivo* at first to form 4-[2-(dipropylamino)ethyl]-6-hydroxyindole (**34**), which is a bioreactive compound.$^{12)}$ This is supported by the fact that **34** exhibits stronger activities than **33** in its bioassay test *in vitro* and *in vivo*.$^{3a)}$ From a synthetic point of view, this compound (**34**) is a good target molecule to show the utility of our procedure described here, since it carries both alkyl and hydroxyl groups on the benzene portion of the indole nucleus. Next we describe successful synthesis of not only the above compound (**34**), but also an analogous compound (**44**), both having dopaminergic activities.

A common intermediate (**37**) was prepared from the 2-formylpyrrole derivative (**23**) in three steps (Chart 6). Methyl 3-nitropropanoate$^{13)}$ was condensed with **23** using ammonium acetate in 61% yield. The resulting α,β-unsaturated nitro compound (**35**), whose *E* structure was determined by an NOE experiment, was reduced with sodium borohydride to obtain the corresponding saturated nitro derivative, which in turn was treated with sodium methoxide and titanium trichloride in the presence of ammonium acetate to afford a β-ketoester derivative (**36**) in 70% yield. Its ketone group was protected as the trimethylene acetal to give the intermediate (**37**) in 71% yield.

The cross condensation of the ester (**37**) and a lithium enolate of *N*,*N*-dipropylacetamide or *N*-propyl-2-piperidone proved to be a crucial step in this scheme.$^{14)}$ The modified reported procedure with addition of potassium *tert*-butoxide$^{15)}$ afforded good results, furnishing the required products (**38** and **41**) in 68% and 76% yields,



a) methyl 3-nitropropanoate, NH_4OAc, MeOH. b) 1) $NaBH_4$, EtOH; 2) NaOMe then $TiCl_3$, NH_4OAc, H_2O. c) $HO(CH_2)_3OH$, *p*-TsOH, benzene. d) $CH_2{=}C(OLi)NPr_2$, *tert*-BuOK, THF. e) $HO(CH_2)_3OH$, *p*-TsOH, toluene. f) 1) $(COCl)_2$, DMSO, Et_3N, CH_2Cl_2; 2) Et_3N, CH_2Cl_2. g) $LiAlH_4$, THF. h) 

, *tert*-BuOK, THF. i) $HO(CH_2)_3OH$, H_2SO_4, $Cl(CH_2)_2Cl$.

Chart 6

accompanied by the formation of a by-product (**45**) in 8% yield in the former case. Indole cyclization of **38** and **41** was performed as above to form **39** and **42** in 79% and 47% yields, whose oxidation with the Swern reagent, followed by brief treatment with triethylamine afforded the 6-hydroxy-4-indolylamide derivatives (**40** and **43**) in 92% yield each. Treatment of these compounds with lithium aluminum hydride effected simultaneously reduction of the amide function and cleavage of the protecting group at the indole nitrogen, producing the objective compounds (**34** and **44**) in 77% and 75% yields. Overall yields from **23** to **34** and **44** were 11.5% and 7.5%, respectively, in seven steps.

During the reduction of **40** with lithium aluminum hydride, a stable by-product, whose structure was assigned as **46**, was obtained in 16% yield. Formation of **46** from **40** is incredible at first glance, but we have previously found that an unusual reaction takes place when the indole nucleus is exposed to reduction with lithium aluminum hydride.16) The key point is probably formation of the indolylaluminum bond as shown in **47** after reductive cleavage of the (arylsulfonyl)indole bond. The aluminum species might be split off as an anion to produce alane and **48**. Here the oxygen function of a partially reduced dipropylamide group would participate to provide an epoxide compound (**49**), whose reactive carbon–oxygen bond adjacent to the nitrogen group is reductively cleaved with lithium aluminum hydride to form the unusual product (**46**).

In summary we have established a novel synthetic procedure for hydroxy-substituted indole derivatives (**6**) by treating **4a**, **4b**, **5a**, and **5b** with a catalytic amount of *p*-toluenesulfonic acid or sulfuric acid. Coupled with the ready preparative methods of **4a**, **4b**, **5a**, and **5b** from **20** and **23**, overall production of **6** from pyrrole offers an efficient, versatile and facile method for variously alkyl-substituted alkoxy- and hydroxyindoles. The utility of the present method was demonstrated by a short-step preparation of dopamine agonist compounds (**34** and **44**). A further application is reported in the subsequent paper.17)

Experimental

Proton nuclear magnetic resonance (^{1}H-NMR) spectra at 400 MHz were recorded on a JEOL JMN-GX-400 spectrometer. For other general descriptions, see the preceding paper.1)

2-[1-(4-Methylphenyl)sulfonyl-3-pyrrolyl]furan (10) A solution of the ketoaldehyde **9** (27 mg, 0.0884 mmol) and 95% H_2SO_4 (5 mg, 0.0484 mmol) in 1,2-dichloroethane (4 ml) was refluxed for 1 h using a Dean-Stark apparatus. After cooling to 0 °C, $NaHCO_3$–H_2O was added and the mixture was extracted with CH_2Cl_2. Usual work-up and separation by preparative thin layer chromatography (PTLC) [hexane–EtOAc (3 : 1)] gave **10** (2.5 mg, 10%) as a purple syrup. MS *m/z*: 287 (M^+). ^{1}H-NMR δ: 2.38 (3H, s), 6.24—6.44 (2H, m), 6.44 (1H, d, $J=3$ Hz), 7.02—7.40 (5H, m), 7.73 (2H, A_2B_2, $J=8.5$ Hz).

4,4-Dimethoxy-1-[1-(4-methylphenyl)sulfonyl-3-pyrrolyl]-1-butanone (12) NaOMe (30 mg, 0.555 mmol) was added to a suspension of 4-nitro-1-[1-(4-methylphenyl)sulfonyl-3-pyrrolyl]-1-butanone (**11**) (125 mg, 0.372 mmol) in MeOH (3 ml) at 0 °C and the mixture was stirred for 10 min. This solution was poured into ice-cold 20% H_2SO_4–MeOH (1.5 ml) using additional MeOH (1.5 ml) for washing the container. This acidic solution was stirred for 10 min at 0 °C and then poured into saturated $NaHCO_3$–H_2O. The whole was extracted with CH_2Cl_2 and worked up as usual. The residue was purified by PTLC [hexane–CH_2Cl_2 (1 : 5)] to afford **12** (118 mg, 90%) as a colorless syrup, together with the starting material (**11**) (9 mg, 7%). **12**: HRMS Calcd for $C_{17}H_{21}NO_5S$: 351.1139. Found: 351.1115. MS *m/z* (relative intensity): 351 (M^+, 6), 320 (27), 263 (100), 260 (25), 248 (69), 196 (55), 165 (24), 155 (99), 91 (88), 89 (93), 75 (87), 65 (99), 47 (95), 41 (84), 39 (90). IR ($CHCl_3$) cm^{-1}: 1679. ^{1}H-NMR δ: 1.97 (2H, dt, $J=5.5$, 7 Hz), 2.37 (3H, s), 2.81 (2H, t, $J=7$ Hz), 3.30 (6H, s), 4.39 (1H, t, $J=5.5$ Hz), 6.64 (1H, dd, $J=3$, 1.5 Hz), 7.11 (1H, dd, $J=3$, 2 Hz), 7.27 and 7.77 (A_2B_2, $J=8.5$ Hz), 7.74 (1H, dd, $J=2$, 1.5 Hz).

Formation of 4-Alkoxyindole Derivatives (13) (Table I) Synthesis of 2-[1-(phenylsulfonyl)-4-indolyloxy]ethanol (**8b**) from **7b** is described as a representative example. A solution of **7b** (120 mg, 0.358 mmol), ethylene glycol (222 mg, 3.58 mmol), and *p*-TsOH·H_2O (13 mg, 0.0683 mmol) in benzene (4 ml) was refluxed using a Dean-Stark apparatus for 8 h, then cooled to 0 °C. Saturated $NaHCO_3$–H_2O was added and the mixture was extracted with CH_2Cl_2. Usual work-up and purification by PTLC [hexane–EtOAc (3 : 2)] gave **8b** (102 mg, 90%) as a colorless syrup, along with the starting material (5 mg, 4% recovery). HRMS Calcd for $C_{16}H_{15}NO_4S$: 317.0721. Found: 317.0716. MS *m/z* (relative intensity): 317 (M^+, 49), 273 (10), 176 (18), 132 (100), 77 (58), 51 (25). ^{1}H-NMR δ: 2.75 (1H, br s, OH), 3.77—4.12 (4H, m), 6.52 (1H, d, $J=8$ Hz), 6.74 (1H, d, $J=4$ Hz), 7.12 (1H, dd, $J=8$, 8 Hz), 7.12—7.47 (3H, m), 7.38 (1H, d, $J=4$ Hz), 7.57 (1H, d, $J=8$ Hz), 7.66—7.89 (2H, m).

4-Methoxy-1-[(4-methylphenyl)sulfonyl]indole (13, R = Me, Ar = 4-Methylphenyl)18) Colorless prisms, mp 125—126 °C (CH_2Cl_2–hexane) (lit.17) mp 123—124 °C). *Anal.* Calcd for $C_{16}H_{15}NO_3S$: C, 63.77; H, 5.02; N, 4.65. Found: C, 63.84; H, 5.04; N, 4.64. MS *m/z* (relative intensity): 301 (M^+, 69), 146 (100), 116 (57), 91 (25), 65 (16). ^{1}H-NMR δ: 2.30 (3H, s), 3.86 (3H, s), 6.61 (1H, d, $J=8$ Hz), 6.73 (1H, d, $J=4$ Hz), 7.17 and 7.72 (A_2B_2, $J=8.5$ Hz), 7.18 (1H, dd, $J=8$, 8 Hz), 7.43 (1H, d, $J=4$ Hz), 7.57 (1H, d, $J=8$ Hz).

4-Benzyloxy-1-[(4-methylphenyl)sulfonyl]indole (13, R = CH_2Ph, Ar = 4-Methylphenyl) Colorless needles, mp 104—105 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{22}H_{19}NO_3S$: C, 70.00; H, 5.07; N, 3.71. Found: C, 70.03; H, 5.11; N, 3.67. MS *m/z*: 377 (M^+). ^{1}H-NMR δ: 2.27 (3H, s), 5.09 (2H, s), 6.64 (1H, d, $J=8$ Hz), 6.77 (1H, d, $J=4$ Hz), 7.12 and 7.70 (A_2B_2, $J=8.5$ Hz), 7.12—7.49 (5H, m), 7.15 (1H, dd, $J=8$, 8 Hz), 7.41 (1H, d, $J=4$ Hz), 7.58 (1H, d, $J=8$ Hz).

4-Benzyloxy-1-(phenylsulfonyl)indole (13, R = CH_2Ph, Ar = Phenyl)19) Colorless needles, mp 129.5—130.5 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{21}H_{17}NO_3S$: C, 69.40; H, 4.71; N, 3.85. Found: C, 69.36; H, 4.60; N, 3.78. MS *m/z*: 363 (M^+). ^{1}H-NMR δ: 5.14 (2H, s), 6.67 (1H, d, $J=8$ Hz), 6.80 (1H, d, $J=4$ Hz), 7.17 (1H, dd, $J=8$, 8 Hz), 7.22—7.51 (8H, m), 7.44 (1H, d, $J=4$ Hz), 7.60 (1H, d, $J=8$ Hz), 7.75—7.98 (2H, m).

3-[1-(4-Methylphenyl)sulfonyl-4-indolyloxy]-1-propanol (14) Colorless syrup. MS *m/z*: 345 (M^+). ^{1}H-NMR δ: 1.98 (2H, tt, $J=6$, 6 Hz), 1.98—2.40 (1H, OH), 2.21 (3H, s), 3.78 (2H, t, $J=6$ Hz), 4.09 (2H, t, $J=6$ Hz), 6.55 (1H, d, $J=8$ Hz), 6.68 (1H, d, $J=4$ Hz), 7.07 and 7.66 (A_2B_2, $J=8$ Hz), 7.12 (1H, dd, $J=8$, 8 Hz), 7.38 (1H, d, $J=4$ Hz), 7.54 (1H, d, $J=8$ Hz).

1,3-Bis[1-(4-methylphenyl)sulfonyl-4-indolyloxy]propane (15) Colorless amorphous powder. HRMS Calcd for $C_{33}H_{30}N_2O_6S_2$: 614.1543. Found: 614.1555. MS *m/z* (relative intensity): 614 (M^+, 14), 460 (17), 328 (24), 174 (42), 173 (38), 172 (39), 155 (27), 91 (100). ^{1}H-NMR δ: 2.12—2.47 (2H, m), 2.28 (6H, s), 4.21 (4H, t, $J=6$Hz), 6.58 (2H, d, $J=8$ Hz), 6.68 (2H, d, $J=4$ Hz), 7.12 (2H, dd, $J=8$, 8 Hz), 7.13 and 7.68 ($2\times A_2B_2$, $J=8.5$ Hz), 7.38 (2H, d, $J=4$ Hz), 7.53 (2H, d, $J=8$ Hz).

4-(2-Methoxyethoxy)-1-[(4-methylphenyl)sulfonyl]indole (13, R = CH_2CH_2OMe, Ar = 4-Methylphenyl) Colorless prisms, mp 107—108.5 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{18}H_{19}NO_4S$: C, 62.59; H, 5.54; N, 4.06. Found: C, 62.48; H, 5.57; N, 3.97. MS *m/z* (relative intensity): 345 (M^+, 57), 287 (21), 132 (46), 91 (49), 65 (23), 29 (100). ^{1}H-NMR δ: 2.27 (3H, s), 3.40 (3H, s), 3.65—3.84 (2H, m), 4.08—4.27 (2H, m), 6.59 (1H, d, $J=8$ Hz), 6.76 (1H, d, $J=3.5$ Hz), 7.13 and 7.71 (A_2B_2, $J=8.5$ Hz), 7.16 (1H, dd, $J=8$, 8 Hz), 7.42 (1H, d, $J=3.5$ Hz), 7.58 (1H, d, $J=8$ Hz).

2-[1-(Phenylsulfonyl)-4-indolylthio]ethanol (16) Colorless syrup. HRMS Calcd for $C_{16}H_{15}NO_3S_2$: 333.0492. Found: 333.0501. MS *m/z* (relative intensity): 333 (M^+, 61), 289 (11), 174 (37), 148 (100), 117 (15), 104 (28), 77 (67), 51 (28). ^{1}H-NMR δ: 2.04 (1H, br s, OH), 3.08 (2H, t, $J=6$ Hz), 3.68 (2H, t, $J=6$ Hz), 6.82 (1H, d, $J=4$ Hz), 7.13—7.58 (5H, m), 7.58 (1H, d, $J=4$ Hz), 7.70—8.01 (3H, m).

Methyl (*S*)-*N*-Benzyloxycarbonyl-*O*-[(1-phenylsulfonyl)-4-indolyl]serinate (17) MS *m/z* (relative intensity): 508 (M^+, 3), 400 (35), 273 (23), 132 (68), 91 (100), 77 (81), 51 (33). IR ($CHCl_3$) cm^{-1}: 1755, 1727. ^{1}H-NMR δ: 3.70 (3H, s), 4.32 (1H, dd, $J=13$, 3 Hz), 4.41 (1H, dd, $J=13$, 3 Hz), 4.72 (1H, ddd, $J=8$, 3, 3 Hz), 5.08 (2H, s), 5.72 (1H, br d, $J=8$ Hz, NH), 6.57 (1H, d, $J=8$ Hz), 6.64 (1H, d, $J=4$ Hz), 7.16 (1H, dd, $J=8$, 8 Hz), 7.19—7.52 (9H, m), 7.60 (1H, d, $J=8$ Hz), 7.71—7.94 (2H, m).

4-Hydroxy-1-[(4-methylphenyl)sulfonyl]indole (18a)4d,20) A 10% (v/v) dimethyl sulfoxide (DMSO)/CH_2Cl_2 (0.84 ml, 1.18 mmol) solution was added dropwise to a solution of 10% (v/v) oxalyl chloride/CH_2Cl_2 (0.35 ml, 0.401 mmol) in CH_2Cl_2 (2 ml) at −82 °C under an Ar atmosphere. The mixture was stirred for 3 min, then a solution of **14** (34 mg, 0.0984 mmol) in CH_2Cl_2 (2 ml) was added at −82 °C, and the resulting suspension was stirred at −82—−67 °C for 30 min. Et_3N (0.27 ml, 1.94 mmol) was added to this at −65 °C and the mixture was stirred for 30 min at −20 °C. Then 0.1 N citric acid–H_2O was added to make pH 7, and the whole was extracted with Et_2O. Usual work-up gave a crude oily product (40 mg). This was dissolved in CH_2Cl_2 (5 ml) containing Et_3N (0.5 ml) and the mixture was refluxed for 2 min. After cooling at 0 °C, 0.1 N citric acid–H_2O was added to adjust the pH to 7 and the mixture was extracted with CH_2Cl_2. Usual work-up and purification by PTLC [hexane–EtOAc (2 : 1)] afforded **18a** (26 mg, 92%) as colorless prisms, mp 146—147 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{15}H_{13}NO_3S$: C, 62.70; H, 4.50; N, 4.88. Found: C, 62.57; H, 4.53; N, 4.88. MS *m/z*: 287 (M^+). ^1H-NMR δ: 2.28 (3H, s), 5.60 (1H, br s, OH), 6.56 (1H, d, $J=8$ Hz), 6.69 (1H, d, $J=4$ Hz), 7.06 (1H, dd, $J=8$, 8 Hz), 7.12 and 7.69 (A_2B_2, $J=8.5$ Hz), 7.41 (1H, d, $J=4$ Hz), 7.52 (1H, d, $J=8$ Hz).

1-Chloro-2-[1-(phenylsulfonyl)-4-indolyloxy]ethane (19) A solution of **8b** (49 mg, 0.154 mmol) and Ph_3P (122 mg, 0.465 mmol) in CCl_4 (2 ml) and dimethylformamide (DMF) (0.5 ml) was refluxed for 4 h, then cooled to 0 °C. Saturated $NaHCO_3$–H_2O was added and the mixture was extracted with Et_2O. Usual work-up and purification by PTLC [hexane–EtOAc (5 : 2)] gave **19** (48 mg, 93%) as colorless prisms, mp 106.5—107.5 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{16}H_{14}ClNO_3S$: C, 57.22; H, 4.20; Cl, 10.56; N, 4.17. Found: C, 57.11; H, 4.24; Cl, 10.53; N, 4.26. HRMS Calcd for $C_{16}H_{14}ClNO_3S$: 335.0382, 337.0353. Found: 335.0392, 337.0335. MS *m/z* (relative intensity): 335, 337 (M^+, 55, 22), 194, 196 (67, 20), 132 (57), 77 (100), 63, 65 (45, 15), 51 (44). ^1H-NMR δ: 3.76 (2H, t, $J=6$ Hz), 4.24 (2H, t, $J=6$ Hz), 6.56 (1H, d, $J=8$ Hz), 6.76 (1H, d, $J=3.5$ Hz), 7.16 (1H, dd, $J=8.5$, 8 Hz), 7.16—7.51 (4H, m), 7.61 (1H, d, $J=8.5$ Hz), 7.72—7.94 (2H, m).

4-Hydroxy-1-(phenylsulfonyl)indole (18b)[4d] A solution of **19** (24 mg, 0.0715 mmol) in tetrahydrofuran (THF) (2 ml) was treated with 15% BuLi–hexane (0.56 ml, 0.896 mmol) under an Ar atmosphere at −80—−65 °C for 1 h. The reaction was quenched by addition of NH_4Cl–H_2O, and the mixture was extracted with CH_2Cl_2. Usual work-up and purification by PTLC [hexane–EtOAc (3 : 1)] yielded **18b** (15.5 mg, 79%) as colorless needles, along with recovered **19** (3.5 mg, 15%). **18b**: mp 133—134 °C (CH_2Cl_2–hexane) (lit.[4d] mp 130.0—130.7 °C). *Anal.* Calcd for $C_{14}H_{11}NO_3S$: C, 61.52; H, 4.06; N, 5.13. Found: C, 61.36; H, 4.22; N, 5.22. HRMS Calcd for $C_{14}H_{11}NO_3S$: 273.0459. Found: 273.0462. MS *m/z* (relative intensity): 273 (M^+, 37), 132 (100), 77 (41), 51 (27). ^1H-NMR δ: 4.42 (1H, br s, OH), 6.57 (1H, d, $J=8$ Hz), 6.72 (1H, d, $J=4$ Hz), 7.09 (1H, dd, $J=8$, 8 Hz), 7.27—7.54 (3H, m), 7.44 (1H, d, $J=4$ Hz), 7.54 (1H, d, $J=8$ Hz), 7.74—7.94 (2H, m).

2-(2-Nitroethyl)-1,3-dioxane This compound was prepared according to the reported procedure for similar compounds.[21] Crude 3-nitropropanal (29.5 g), prepared from 80% acrolein (24.2 g, 0.346 mmol) and $NaNO_2$–HOAc, was dissolved in benzene (210 ml) containing 1,3-propanediol (28.3 g, 0.372 mol). *p*-TsOH·H_2O (2.72 g) was added and the mixture was stirred under reflux for 3 h with azeotropic removal of H_2O. After cooling, the mixture was adjusted to pH 7 with $NaHCO_3$–H_2O and the benzene layer was separated. The aqueous layer was extracted with CH_2Cl_2 and the combined organic solution was worked up as usual. The residual oil was distilled under reduced pressure to give 2-(2-nitroethyl)-1,3-dioxane (22.5 g, 41%) as a pale yellow oil, bp 80—83 °C (0.8 mmHg). GC-MS *m/z* (relative intensity): 161 (M^+, 0.7), 160 (7), 114 (35), 113 (23), 87 (100), 57 (33). IR ($CHCl_3$) cm^{-1}: 1560, 1390. ^1H-NMR δ: 1.18—1.47 (1H, m), 1.59—2.44 (3H, m), 3.54—4.24 (4H, m), 4.49 (2H, t, $J=7$ Hz), 4.68 (1H, t, $J=4.5$ Hz).

(*E*)-3-(1,3-Dioxan-2-yl)-2-nitro-1-(1-phenylsulfonyl-3-pyrrolyl)-1-propene (21) A solution of 3-formyl-1-(phenylsulfonyl)pyrrole (**20**)[1,5] (303 mg, 1.29 mmol), 2-(2-nitroethyl)-1,3-dioxane (838 mg, 5.20 mmol), and NH_4OAc (800 mg, 10.4 mmol) in CH_3CN (10 ml) was refluxed for 15 h. After the mixture had been cooled, NH_4Cl–H_2O was added and the whole was extracted with CH_2Cl_2. The organic solution was washed with saturated $NaHCO_3$–H_2O and worked up as usual. The residue was purified by column chromatography over silica gel [45 g, hexane–dimethoxyethane (DME) (4 : 1)] to give **21** (458 mg, 94%) as a yellow amorphous solid. The corresponding unstable *Z*-isomer was obtained in a trace amount. HRMS Calcd for $C_{17}H_{18}N_2O_6S$: 378.0884. Found: 378.0891. MS *m/z* (relative intensity): 378 (M^+, 0.5), 361 (0.7), 245 (1), 141 (2), 104 (4), 87 (100), 77 (25). IR ($CHCl_3$) cm^{-1}: 1660, 1517, 1327. ^1H-NMR δ: 1.20—1.50 (1H, m), 1.81—2.44 (1H, m), 3.13 (2H, d, $J=5.5$ Hz), 3.56—4.27 (4H, m), 4.86 (1H, t, $J=5.5$ Hz), 6.69 (1H, dd, $J=3.5$, 1.5 Hz), 7.15—7.32 (1H, m), 7.40—7.82 (4H, m), 7.82—8.07 (2H, m), 7.98 (1H, s).

1-(1,3-Dioxan-2-yl)-3-(1-phenylsulfonyl-3-pyrrolyl)-2-propanone (22) $NaBH_4$ (34.5 mg, 0.912 mmol) was added to a suspension of **21** (218.5 mg, 0.577 mmol) in EtOH (10 ml) at 0 °C and the mixture was stirred at room temperature for 1 h. NaOMe (37 mg, 0.685 mmol) was added to the resulting colorless solution and the mixture was further stirred for 5 min. To this was added a solution of 20% (w/v) $TiCl_3$ (6.7 ml, 8.66 mmol) and NH_4OAc (4.00 g, 51.9 mmol) in H_2O (10 ml), and the whole was stirred under an Ar atmosphere for 3 h. H_2O and EtOAc were added and the black-blue solution was vigorously shaken until it turned into a colorless suspension. The inorganic material was filtered off through a Celite bed and the filtrate was extracted with EtOAc. The organic solution was washed with $NaHCO_3$–H_2O and worked up as usual. Purification of the residue by PTLC [hexane–EtOAc (2 : 1)] afforded **22** (166.5 mg, 83%) as a colorless syrup. HRMS Calcd for $C_{17}H_{19}NO_5S$: 349.0983. Found: 349.0976. MS *m/z* (relative intensity): 349 (M^+, 1), 247 (9), 220 (15), 208 (35), 141 (12), 87 (100), 77 (38). IR ($CHCl_3$) cm^{-1}: 1723. ^1H-NMR δ: 1.13—1.45 (1H, m), 1.72—2.32 (1H, m), 2.69 (2H, d, $J=5.5$ Hz), 3.44—4.20 (4H, m), 3.56 (2H, s), 4.89 (1H, t, $J=5.5$ Hz), 6.17 (1H, dd, $J=2.5$, 2.5 Hz), 7.08 (2H, d, $J=2.5$ Hz), 7.25—7.70 (3H, m), 7.70—7.97 (2H, m).

(*E*)-3-(1,3-Dioxan-2-yl)-2-nitro-1-(1-phenylsulfonyl-2-pyrrolyl)-1-propene (24) Employing a similar procedure to that described for the preparation of **21**, 2-formyl-1-(phenylsufonyl)pyrrole (**23**)[6,7] (739.5 mg, 3.14 mmol) was condensed with 2-(2-nitroethyl)-1,3-dioxane (2.03 g, 12.6 mmol) by refluxing in CH_3CN (27 ml) for 14 h in the presence of NH_4OAc (2.18 g, 28.3 mmol) to give **24** (1.027 g, 86%) and the corresponding *Z*-isomer (15 mg, 1%). **24**: Yellow prisms, mp 108—109 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{17}H_{18}N_2O_6S$: C, 53.96; H, 4.79; N, 7.40. Found: C, 53.94; H, 4.77; N, 7.40. HRMS Calcd for $C_{17}H_{18}N_2O_6S$: 378.0884. Found: 378.0888. MS *m/z* (relative intensity): 378 (M^+, 2), 235 (3), 190 (4), 180 (2), 141 (19), 104 (48), 87 (83), 77 (100), 59 (100). IR (KBr) cm^{-1}: 1643, 1508, 1300. ^1H-NMR (400 MHz) δ: 1.31—1.38 (1H, m), 2.00—2.14 (1H, m), 3.00 (2H, d, $J=5.5$ Hz), 3.68—3.78 (2H, m), 4.03—4.10 (2H, m), 4.87 (1H, t, $J=5.5$ Hz), 6.42 (1H, dd, $J=3.7$, 3.7 Hz), 7.20—7.25 (1H, m), 7.49—7.56 (2H, m), 7.60—7.66 (2H, m), 7.82—7.87 (2H, m), 8.58 (1H, s). *Z*-Isomer: Yellow syrup. HRMS Calcd for $C_{17}H_{18}N_2O_6S$: 378.0884. Found: 378.0872. MS *m/z* (relative intensity): 378 (M^+, 2), 346 (9), 259 (3), 141 (13), 125 (5), 120 (6), 118 (8), 104 (23), 87 (100), 77 (84), 59 (74). IR ($CHCl_3$) cm^{-1}: 1534, 1375. ^1H-NMR δ: 1.18—1.50 (1H, m), 1.81—2.42 (1H, m), 2.92 (2H, d, $J=5$ Hz), 3.60—4.28 (4H, m), 4.77 (1H, t, $J=5$ Hz), 6.24 (1H, dd, $J=3.5$, 3.5 Hz), 6.58—6.75 (1H, m), 7.13 (1H, br s), 7.31—7.73 (4H, m), 7.73—7.94 (2H, m).

1-(1,3-Dioxan-2-yl)-3-(1-phenylsulfonyl-2-pyrrolyl)-2-propanone (25) Employing a similar procedure to that described for the preparation of **22**, **25** (68 mg, 90%) was obtained from **24** (82 mg, 0.217 mmol). Colorless syrup. HRMS Calcd for $C_{17}H_{19}NO_5S$: 349.0983. Found: 349.0969. MS *m/z*: 349 (M^+). IR ($CHCl_3$) cm^{-1}: 1728. ^1H-NMR δ: 1.17—1.46 (1H, m), 1.74—2.36 (1H, m), 2.73 (2H, d, $J=5.5$ Hz), 3.56—4.23 (4H, m), 3.89 (2H, s), 4.90 (1H, t, $J=5.5$ Hz), 6.04—6.16 (1H, m), 6.21 (1H, dd, $J=3$, 3 Hz), 7.21 (1H, dd, $J=3$, 1.5 Hz), 7.31—7.61 (3H, m), 7.61—7.84 (2H, m).

3-(1,3-Dioxolan-2-yl)-1-(1-phenylsulfonyl-2-pyrrolyl)-1-propanol (26) A solution of **23** (400 mg, 1.70 mmol) in THF (5 ml) was treated at −20 °C for 10 min under an Ar atmosphere with the reagent (2.8 ml), prepared from Mg (108 mg, 4.44 mg atom) and 2-(1,3-dioxolan-2-yl)ethyl bromide (0.72 ml) in THF (4.1 ml). Addition of saturated NH_4Cl–H_2O, followed by extraction with CH_2Cl_2, usual work-up, and column chromatography [hexane–EtOAc (1 : 1)] afforded **26** (554 mg, 97%) as a colorless syrup. HRMS Calcd for $C_{16}H_{19}NO_5S$: 337.0984. Found: 337.0970. MS *m/z* (relative intensity): 337 (M^+, 0.4), 319 (0.3), 236 (26), 196 (8), 178 (11), 141 (27), 129 (59), 77 (87), 73 (100). ^1H-NMR δ: 1.53—2.08 (4H, m), 3.05 (1H, d, $J=4.5$ Hz, OH), 3.63—4.03 (4H, m), 4.71—5.03 (2H, m), 6.11—6.33 (2H, m), 7.22 (1H, dd, $J=3$, 1.5 Hz), 7.28—7.64 (3H, m), 7.64—7.84 (2H, m).

3-(1,3-Dioxolan-2-yl)-1-(1-phenylsulfonyl-2-pyrrolyl)-1-propanone (27) A mixture of **26** (304 mg, 0.901 mmol) and MnO_2 (1.18 g, 13.6 mmol) in CH_2Cl_2 (15 ml) was stirred at room temperature for 7 h. Inorganic material was filtered off and washed with CH_2Cl_2. Evaporation of the filtrate and purification of the residue by PTLC [hexane–EtOAc (2 : 1)] gave **27** (245 mg, 81%) as colorless needles, mp 107—108 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{16}H_{17}NO_5S$: C, 57.30; H, 5.11; N, 4.18. Found: C, 57.14; H, 5.11; N, 4.16. MS *m/z* (relative intensity): 335 (M^+, 0.3), 334 (1), 275 (3), 234 (9), 194 (90), 141 (16), 99 (85), 77 (82), 73 (100). IR ($CHCl_3$) cm^{-1}: 1677. ^1H-NMR δ: 1.95 (2H, dt, $J=4.5$, 7.5 Hz), 2.82 (2H, t, $J=7.5$ Hz), 3.63—4.03 (4H, m), 4.84 (1H, t, $J=4.5$ Hz), 6.30 (1H, dd, $J=3.5$, 3.5 Hz), 7.04 (1H, dd, $J=3.5$, 1.5 Hz), 7.33—7.67 (3H, m), 7.77 (1H, dd, $J=3.5$, 1.5 Hz), 7.86—8.08 (2H, m).

Formation of 5-, 6-, and 7-Alkoxyindole Derivatives (28) (Table II) Syntheses of 5-hydroxy- (run 1) and 5-methoxy-1-(phenylsulfonyl)indoles (run 2) are described as typical examples. A solution of **22** (46 mg, 0.132 mmol) in 10% HCl–H_2O (1.5 ml) and DME (3 ml) was stirred at 50 °C (bath temperature) for 6.5 h. After cooling to 0 °C, the mixture was adjusted to pH 5 by addition of saturated $NaHCO_3$–H_2O, followed by 20% citric acid–H_2O, and extracted with CH_2Cl_2. The organic solution was washed with dilute $NaHCO_3$–H_2O until the washings became neutral (pH 7), dried over Na_2SO_4, and concentrated *in vacuo*. The residue was purified by PTLC [hexane–EtOAc (2:1)] to yield 5-hydroxy-1-(phenylsulfonyl)indole (**28**, 5-OH) (33.5 mg, 93%) as colorless prisms, mp 149—150 °C (CH_2Cl_2–hexane), together with the starting material (**22**) (2 mg, 4%). *Anal.* Calcd for $C_{14}H_{11}NO_3S$: C, 61.53; H, 4.06; N, 5.12. Found: C, 61.39; H, 4.08; N, 5.01. MS m/z (relative intensity): 273 (M^+, 55), 132 (100), 77 (40). ^{1}H-NMR [$CDCl_3$–CD_3OD (5:1)] δ: 6.50 (1H, d, $J=3.5$ Hz), 6.74—6.96 (2H, m), 7.23—7.61 (4H, m), 7.65—7.95 (3H, m). For the 5-methoxy derivative, a solution of **22** (59 mg, 0.169 mmol) and *p*-TsOH·H_2O (13 mg, 0.0683 mmol) in $HC(OMe)_3$ (1.2 ml) and MeOH (3.6 ml) was refluxed for 1 h, then cooled to 0 °C. Saturated $NaHCO_3$–H_2O was added and the mixture was extracted with CH_2Cl_2. Usual work-up and PTLC [hexane–CH_2Cl_2 (2:1)] afforded 5-methoxy-1-(phenylsulfonyl)indole (**28**, 5-MeO) (43 mg, 89%) as colorless prisms, mp 97.5—98.5 °C (CH_2Cl_2–hexane) (lit.[10a)] mp 98—99 °C). *Anal.* Calcd for $C_{15}H_{13}NO_3S$: C, 62.70; H, 4.56; N, 4.87. Found: C, 62.69; H, 4.57; N, 4.83. MS m/z (relative intensity): 287 (M^+, 42), 146 (100), 141 (3), 131 (7), 103 (22), 77 (32). ^{1}H-NMR δ: 3.79 (3H, s), 6.56 (1H, d, $J=3.5$ Hz), 6.82—7.05 (2H, m), 7.21—7.61 (3H, m), 7.50 (1H, d, $J=3.5$ Hz), 7.75—8.02 (3H, m).

6-Hydroxy-1-(phenylsulfonyl)indole (30) Colorless needles, mp 162—162.5 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{14}H_{11}NO_3S$: C, 61.53; H, 4.06; N, 5.12. Found: C, 61.34; H, 4.13; N, 5.14. MS m/z (relative intensity): 273 (M^+, 35), 132 (100), 77 (33). ^{1}H-NMR [$CDCl_3$–CD_3OD (5:1)] δ: 6.54 (1H, d, $J=3.5$ Hz), 6.76 (1H, dd, $J=8.5$, 2.5 Hz), 7.22—7.64 (5H, m), 7.37 (1H, d, $J=3.5$ Hz), 7.75—7.97 (2H, m).

6-Methoxy-1-(phenylsulfonyl)indole (28, 6-OMe) Colorless prisms, mp 141—142 °C (CH_2Cl_2–hexane) (lit.[9)] mp 140—142 °C). *Anal.* Calcd for $C_{15}H_{13}NO_3S$: C, 62.70; H, 4.56; N, 4.87. Found: C, 62.83; H, 4.54; N, 4.98. MS m/z (relative intensity): 287 (M^+, 30), 146 (100), 138 (13), 103 (13), 77 (15). ^{1}H-NMR δ: 3.87 (3H, s), 6.55 (1H, d, $J=3.5$ Hz), 6.83 (1H, dd, $J=8.5$, 2.5 Hz), 7.26—7.64 (5H, m), 7.52 (1H, d, $J=2.5$ Hz), 7.76—7.96 (2H, m).

3-(1-Phenylsulfonyl-6-indolyloxy)-1-propanol (29) Colorless syrup. HRMS Calcd for $C_{17}H_{17}NO_4S$: 331.0877. Found: 331.0877. MS m/z (relative intensity): 331 (M^+, 51), 273 (6), 190 (24), 132 (100), 77 (32). ^{1}H-NMR δ: 1.82—2.25 (1H, m, OH), 2.04 (2H, tt, $J=6$, 6 Hz), 3.85 (2H, t, $J=6$ Hz), 4.14 (2H, t, $J=6$ Hz), 6.52 (1H, d, $J=3.5$ Hz), 6.81 (1H, dd, $J=8.5$, 2.5 Hz), 7.20—7.60 (5H, m), 7.51 (1H, d, $J=2.5$ Hz), 7.71—7.94 (2H, m).

7-Methoxy-1-(phenylsulfonyl)indole (31) Colorless prisms, mp 89—90 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{15}H_{13}NO_3S$: C, 62.70; H, 4.56; N, 4.87. Found: C, 62.75; H, 4.65; N, 4.85. MS m/z (relative intensity): 287 (M^+, 78), 146 (99), 118 (100), 116 (100), 89 (73), 77 (87). ^{1}H-NMR δ: 3.66 (3H, s), 6.54—6.75 (1H, m), 6.61 (1H, d, $J=4$ Hz), 6.95—7.23 (2H, m), 7.27—7.62 (3H, m), 7.70—7.96 (2H, m), 7.81 (1H, d, $J=4$ Hz).

2-(1-Phenylsulfonyl-7-indolyloxy)-1-ethanol [28, 7-O$(CH_2)_2$OH] Colorless syrup. HRMS Calcd for $C_{16}H_{15}NO_4S$: 317.0721. Found: 317.0701. MS m/z (relative intensity): 317 (M^+, 86), 273 (18), 176 (37), 132 (100), 104 (24), 77 (82). ^{1}H-NMR δ: 2.01 (1H, br s, OH), 3.87—4.07 (2H, m), 4.07—4.28 (2H, m), 6.62 (1H, d, $J=8$ Hz), 6.77 (1H, d, $J=4$ Hz), 7.19 (1H, dd, $J=8$, 8 Hz), 7.34—7.53 (4H, m), 7.61 (1H, d, $J=8$ Hz), 7.76—7.97 (2H, m).

Conversion of 29 to 30 According to the same procedure as described for the preparation of **18** from **14**, **30** (29 mg, 88%) was obtained from **29** (40 mg, 0.121 mmol) as colorless needles, mp 162—162.5 °C (CH_2Cl_2–hexane).

7-Hydroxy-1-(phenylsulfonyl)indole (32) A solution of **31** (21 mg, 0.0731 mmol) in CH_2Cl_2 (2.5 ml) was added dropwise to a solution of 10% (v/v) BBr_3–CH_2Cl_2 (0.14 ml, 0.148 mmol) in CH_2Cl_2 (1.5 ml) at −50 °C, and the mixture was stirred at −50—−40 °C for 30 min, then poured into ice-cold 3.5% HCl–H_2O and extracted with CH_2Cl_2. The CH_2Cl_2 solution was washed with dilute $NaHCO_3$–H_2O until the washings became neutral (pH 7) and worked up as usual. The residue was purified by PTLC [hexane–EtOAc (6:1)] to afford **32** (4.5 mg, 23%) as colorless prisms, mp 121—123 °C (Et_2O–hexane). *Anal.* Calcd for $C_{14}H_{11}NO_3S$: C, 61.53; H, 4.06; N, 5.12. Found: C, 61.11; H, 4.00; N, 5.22. HRMS Calcd for $C_{14}H_{11}NO_3S$: 273.0459. Found: 273.0439. MS m/z (relative intensity): 273 (M^+, 67), 132 (100), 104 (84), 77 (66). ^{1}H-NMR δ: 6.62 (1H, d, $J=4$ Hz), 6.82—7.17 (3H, m), 7.27—7.57 (3H, m), 7.41 (1H, d, $J=4$ Hz), 7.70—7.91 (2H, m), 8.66 (1H, s, OH).

Methyl (*E*)-3-Nitro-4-(1-phenylsulfonyl-2-pyrrolyl)-3-butenoate (35) A solution of **23** (353 mg, 1.50 mmol), methyl 3-nitropropanoate[13)] (595 mg, 0.714 mmol), and NH_4OAc (279 mg, 3.62 mmol) in MeOH (20 ml) was heated at 60 °C (bath temperature) for 9 h. After cooling of the mixture, saturated $NaHCO_3$–H_2O was added, then the whole was extracted with CH_2Cl_2, and worked up as usual. Purification by column chromatography over silica gel [45 g, hexane–EtOAc (4:1)] gave **35** (320 mg, 61%) as yellow prisms, mp 102—103 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{15}H_{14}N_2O_6S$: C, 51.43; H, 4.03; N, 8.00. Found: C, 51.35; H, 4.16; N, 7.95. MS m/z (relative intensity): 350 (M^+, 2), 319 (2), 303 (3), 291 (1), 235 (27), 209 (6), 141 (72), 77 (100). IR (KBr) cm^{-1}: 1742, 1648, 1525, 1330. ^{1}H-NMR (400 MHz) δ: 3.72 (3H, s), 3.76 (2H, s), 6.44 (1H, dd, $J=3.5$, 3.5 Hz), 6.60—6.63 (1H, m), 7.53—7.59 (2H, m), 7.63—7.69 (2H, m), 7.85—7.90 (2H, m), 8.66 (1H, s).

Methyl 3-Oxo-4-(1-phenylsulfonyl-2-pyrrolyl)butanoate (36) According to the procedure described for **22** and **25**, a suspension of **35** (179 mg, 0.511 mmol) in EtOH (10 ml) was treated with $NaBH_4$ (38.5 mg, 1.02 mmol) at room temperature for 35 min. To this was added successively NaOMe (33 mg, 0.611 mmol) and a solution of 20% (w/v) $TiCl_3$–H_2O (5.90 ml) and NH_4OAc (3.54 g) in H_2O (6 ml), and stirring was continued at room temperature for 3 h. A similar work-up and PTLC [hexane–EtOAc (3:1)] afforded **36** (115.5 mg, 70%) and methyl (*E*)-4-(1-phenylsulfonyl-2-pyrrolyl)-2-butenoate (16 mg, 10%). **36**: Colorless syrup. HRMS Calcd for $C_{15}H_{15}NO_5S$: 321.0670. Found: 321.0663. MS m/z (relative intensity): 321 (M^+, 13), 220 (67), 180 (48), 148 (32), 141 (60), 77 (100). IR ($CHCl_3$) cm^{-1}: 1746, 1727. ^{1}H-NMR δ: 3.48 (2H, s), 3.71 (3H, s), 3.94 (2H, s), 6.07—6.20 (1H, m), 6.24 (1H, dd, $J=3.5$, 3.5 Hz), 7.25 (1H, dd, $J=3.5$, 2 Hz), 7.35—7.63 (3H, m), 7.63—7.86 (2H, m). Methyl (*E*)-4-(1-phenylsulfonyl-2-pyrrolyl)-2-butenoate: Colorless syrup. HRMS Calcd for $C_{15}H_{15}NO_4S$: 305.0721. Found: 305.0716. MS m/z (relative intensity): 305 (M^+, 20), 246 (7), 164 (49), 132 (39), 104 (75), 77 (100). IR ($CHCl_3$) cm^{-1}: 1720, 1658. ^{1}H-NMR δ: 3.45—3.80 (2H, m), 3.70 (3H, s), 5.65 (1H, dt, $J=15.5$, 1.5 Hz), 5.93—6.08 (1H, m), 6.21 (1H, dd, $J=3.5$, 3.5 Hz), 6.86 (1H, dt, $J=15.5$, 6.5 Hz), 7.30 (1H, dd, $J=3.5$, 2 Hz), 7.37—7.61 (3H, m), 7.61—7.84 (2H, m).

Methyl 3-Oxo-4-(1-phenylsulfonyl-2-pyrrolyl)butanoate Trimethylene Acetal (37) A mixture of **36** (105 mg, 0.327 mmol), 1,3-propanediol (403 mg, 5.30 mmol), and *p*-TsOH·H_2O (12.5 mg, 0.0657 mmol) in benzene (6 ml) was refluxed for 5 h using a Dean-Stark apparatus. After cooling of the mixture to 0 °C, saturated $NaHCO_3$–H_2O was added and the mixture was extracted with CH_2Cl_2. Usual work-up and purification by PTLC [benzene–EtOAc (20:1)] gave **37** (88 mg, 71%) with recovery of the starting material (5 mg, 5%). **37**: Colorless needles, mp 71—72 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{18}H_{21}NO_6S$: C, 56.98; H, 5.58; N, 3.69. Found: C, 56.72; H, 5.60; N, 3.82. HRMS Calcd for $C_{18}H_{21}NO_6S$: 379.1088. Found: 379.1105. MS m/z (relative intensity): 379 (M^+, 0.03), 348 (0.3), 306 (7), 220 (5), 159 (100), 141 (5), 101 (40), 77 (24), 59 (9). IR (KBr) cm^{-1}: 1724. ^{1}H-NMR δ: 1.61 (2H, tt, $J=6$, 6 Hz), 2.79 (2H, s), 3.44 (2H, s), 3.54—4.09 (4H, m), 3.67 (3H, s), 6.20 (1H, dd, $J=3.5$, 3.5 Hz), 6.27—6.40 (1H, m), 7.29 (1H, dd, $J=3.5$, 2 Hz), 7.37—7.63 (3H, m), 7.63—7.94 (2H, m).

***N*,*N*-Dipropyl-3,5-dioxo-6-(1-phenylsulfonyl-2-pyrrolyl)hexanamide 5-Trimethylene Acetal (38)** A THF solution (1.5 ml) of *N*,*N*-dipropylacetamide (132 mg, 0.922 mmol) was added at −80 °C to a solution of lithium diisopropylamide (LDA), prepared from diisopropylamine (0.16 ml, 1.14 mmol) and 15% BuLi–hexane (0.58 ml, 0.922 mmol) in THF (3.5 ml) under an Ar atmosphere at −20 °C for 15 min, and the mixture was stirred at −80—−70 °C for 45 min. *tert*-BuOK (52 mg, 0.463 mmol) was added at −80 °C, and 3 min later, a THF solution (2.5 ml) of **37** (50 mg, 0.132 mmol) was added, then the mixture was stirred at −80—−60 °C for 1.5 h. The reaction was quenched with saturated NH_4Cl–H_2O and the mixture was extracted with CH_2Cl_2. Usual work-up and purification by PTLC [hexane–DME (4:1)] and PTLC [CH_2Cl_2–EtOAc (10:1)] afforded **38** (44 mg, 68%), along with **45** (7 mg, 8%). **38**: Colorless syrup. HRMS Calcd for $C_{25}H_{34}N_2O_6S$: 490.2136. Found: 490.2127. MS m/z (relative intensity): 490 (M^+, 7), 349 (2), 321 (5), 306 (12), 270 (100), 220 (10), 170 (27), 127 (52), 101 (58), 77 (52). IR ($CHCl_3$) cm^{-1}: 1718, 1633, 1588. ^{1}H-NMR δ: 0.93 (6H, t, $J=7.5$ Hz), 1.21—1.97 (6H, m), 2.63 and 2.79 (the former is ascribed to the enol form, total 2H, s each), 2.94—3.42 (4H, m), 3.37 (2H, s), 3.63, 5.03 and 14.77 (the latter two are ascribed to the enol form; total 2H; s, s, and br s, respectively), 3.69—4.09 (4H, m), 6.19 (1H, dd, $J=3.5$, 3.5 Hz), 6.24—6.39 (1H, m), 7.26 (1H, dd, $J=3.5$, 2 Hz), 7.34—7.58 (3H, m), 7.58—7.81 (2H, m). **45**: Colorless syrup. HRMS Calcd for $C_{33}H_{51}N_3O_7S$: 633.3445. Found: 633.3431. MS *m/z* (relative intensity): 633 (M^+, 1), 615 (6), 490 (4), 413 (17), 395 (36), 313 (35), 294 (100), 270 (36), 212 (49), 141 (15), 128 (41), 77 (48), 43 (100). IR ($CHCl_3$) cm^{-1}: 1623. ^{1}H-NMR δ: 0.90 (6H, t, $J=7.5$ Hz), 0.93 (6H, t, $J=7.5$ Hz), 1.19—1.88 (10H, m), 2.18 (2H, s), 2.75 (2H, d, $J=16.5$ Hz), 3.05 (2H, d, $J=16.5$ Hz), 3.03—3.49 (8H, m), 3.41 (2H, s), 3.56—4.03 (4H, m), 5.84 (1H, br s, OH), 6.17 (1H, dd, $J=3.5$, 3.5 Hz), 6.25—6.38 (1H, m), 7.27 (1H, dd, $J=3.5$, 2 Hz), 7.33—7.57 (3H, m), 7.63—7.87 (2H, m).

***N,N*-Dipropyl-[6-(3-hydroxypropoxyl)-1-phenylsulfonyl]indole-4-acetamide (39)** A mixture of **38** (29 mg, 0.0591 mmol), 1,3-propanediol (67 mg, 0.880 mmol), and *p*-TsOH·H_2O (4.5 mg, 0.0237 mmol) in toluene (4 ml) was refluxed for 30 min using a Dean-Stark apparatus, then cooled to 0 °C. Saturated $NaHCO_3$–H_2O was added, and the mixture was extracted with CH_2Cl_2 and worked up as usual. Purification by PTLC [hexane–EtOAc (1 : 1)] yielded **39** (22 mg, 79%) as a colorless syrup. HRMS Calcd for $C_{25}H_{32}N_2O_5S$: 472.2030. Found: 472.2046. MS *m/z* (relative intensity): 472 (M^+, 63), 414 (2), 371 (3), 344 (6), 332 (41), 204 (21), 142 (13), 141 (8), 128 (100), 86 (54), 77 (68), 43 (61). IR ($CHCl_3$) cm^{-1}: 1633. ^{1}H-NMR δ: 0.83 (6H, t, $J=7.5$ Hz), 1.16—1.71 (4H, m), 1.89 (1H, br s, OH), 2.03 (2H, tt, $J=6$, 6 Hz), 2.97—3.38 (4H, m), 3.80 (2H, s), 3.83 (2H, t, $J=6$ Hz), 4.13 (2H, t, $J=6$ Hz), 6.63 (1H, d, $J=3.5$ Hz), 6.72 (1H, d, $J=2.5$ Hz), 7.24—7.61 (4H, m), 7.43 (1H, d, $J=2.5$ Hz), 7.70—7.93 (2H, m).

***N,N*-Dipropyl-(6-hydroxy-1-phenylsulfonyl)indole-4-acetamide (40)** According to the same procedure as employed in the preparation of **30** from **29**, **40** (59.5 mg, 92%) was obtained from **39** (74 mg, 0.157 mmol), as colorless prisms, mp 172.5—173.5 °C (CH_2Cl_2–hexane). *Anal.* Calcd for $C_{22}H_{26}N_2O_4S$: C, 63.75; H, 6.32; N, 6.76. Found: C, 63.50; H, 6.31; N, 6.68. MS *m/z* (relative intensity): 414 (M^+, 40), 286 (11), 274 (14), 173 (17), 145 (19), 128 (100), 77 (51), IR (KBr) cm^{-1}: 1630, 1613, 1594. ^{1}H-NMR [$CDCl_3$–CD_3OD (5 : 1)] δ: 0.70 (3H, t, $J=7$ Hz), 0.84 (3H, t, $J=7$ Hz), 1.08—1.77 (4H, m), 2.96—3.39 (4H, m), 3.79 (2H, s), 6.53—6.72 (2H, m), 7.24—7.62 (5H, m), 7.70—7.94 (2H, m).

4-[2-(Dipropylamino)ethyl]-6-hydroxyindole (34) A THF solution (2 ml) of **40** (28 mg, 0.0675 mmol) was added to a stirred suspension of $LiAlH_4$ (26 mg, 0.685 mmol) in THF (1 ml) under an Ar atmosphere at room temperature and the mixture was refluxed for 3.5 h, then cooled to 0 °C. The reaction was quenched with saturated Rochelle salt in H_2O and the whole was filtered through a Celite bed. The filtrate and CH_2Cl_2 washings were extracted with CH_2Cl_2, while the pH of the aqueous layer was about 10. The aqueous layer was adjusted to pH 7—8 with 10% citric acid–H_2O and extracted with CH_2Cl_2. The combined organic solution was worked up as usual to give the residue (18 mg), which was purified by Al_2O_3 PTLC [hexane–EtOAc (2 : 1)] to afford **34** (13.5 mg, 77%) and **46** (3 mg, 16%). **34**: Colorless prisms, mp 139—140.5 °C (benzene). *Anal.* Calcd for $C_{16}H_{24}N_2O$: C, 73.81; H, 9.29; N, 10.76. Found: C, 73.52; H, 9.19; N, 10.55. MS *m/z* (relative intensity): 260 (M^+, 1), 229 (2), 146 (6), 114 (100). ^{1}H-NMR [$CDCl_3$–CD_3OD (5 : 1)] δ: 0.90 (6H, t, $J=7$ Hz), 1.19—1.83 (4H, m), 2.37—2.71 (4H, m), 2.71—3.16 (4H, m), 6.37 (1H, d, $J=3.5$ Hz), 6.47 (1H, d, $J=2$ Hz), 6.61—6.74 (1H, m), 7.00 (1H, d, $J=3.5$ Hz), 9.41 (less than 1H, br s, NH). **46**: Colorless syrup. HRMS Calcd for $C_{16}H_{24}N_2O_2$: 276.1836. Found: 276.1853. MS *m/z* (relative intensity): 276 (M^+, 1), 258 (2), 161 (4), 114 (100). ^{1}H-NMR δ: 0.94 (6H, t, $J=6$ Hz), 1.37—1.76 (4H, m), 2.28—2.83 (6H, m), 2.83—3.38 (2H, m, OH × 2), 5.01 (1H, dd, $J=9$, 5 Hz), 6.33—6.54 (1H, m, changed to 6.45, d, $J=3$ Hz with D_2O), 6.63—6.76 (1H, m), 6.76—6.91 (1H, m), 6.91—7.07 (1H, m, changed to 7.01, d, $J=3$ Hz with D_2O), 7.95—8.17 (1H, m, NH).

1-(2-Oxo-1-propyl-3-piperidyl)-4-(1-phenylsulfonyl-2-pyrrolyl)-1,3-butanedione 3-Trimethylene Acetal (41) According to a similar procedure to that employed in the preparation of **38**, **41** (49 mg, 76%) was obtained from **37** (50 mg, 0.132 mmol) and the lithium enolate (0.921 mmol) of *N*-propyl-2-piperidone.[22] Colorless syrup. HRMS Calcd for $C_{25}H_{32}N_2O_6S$: 488.1979. Found: 488.1968. MS *m/z* (relative intensity): 488 (M^+, 7), 347 (11), 306 (17), 268 (100), 168 (32), 127 (51), 101 (31), 77 (27). IR ($CHCl_3$) cm^{-1}: 1715, 1631. ^{1}H-NMR δ: 0.86, 0.90 (total 3H, t each, $J=7.5$ Hz), 1.23—2.13, 2.13—2.46 (total 8H, m each), 2.66, 2.80, 3.47 (total 2H; s; d, $J=14.5$ Hz; d, $J=14.5$ Hz, respectively), 2.99—3.48 (4H, m), 3.36 (2H, s), 3.48—4.15, 14.89 (total 5H, m and br s, respectively; the latter is ascribed to OH of the enol form), 6.18 (1H, dd, $J=3.5$, 3.5 Hz), 6.27—6.46 (1H, m), 7.17—7.33 (1H, m), 7.33—7.58 (3H, m), 7.58—7.84 (2H, m).

6-(3-Hydroxypropoxy)-4-(2-oxo-1-propyl-3-piperidyl)-1-(phenylsulfonyl)indole (42) A mixture of **41** (21 mg, 0.0430 mmol), 1,3-propanediol (123 mg, 1.62 mmol), and 95% H_2SO_4 (8.5 mg, 0.0823 mmol) in $ClCH_2CH_2Cl$ (4 ml) was refluxed for 14 h using a Dean-Stark apparatus, then cooled to 0 °C. Saturated $NaHCO_3$–H_2O was added, then the mixture was extracted with CH_2Cl_2 and worked up as usual. Purification by PTLC [CH_2Cl_2–EtOAc (3 : 1)] afforded **42** (9.5 mg, 47%) as a colorless syrup. HRMS Calcd for $C_{25}H_{30}N_2O_5S$: 470.1874. Found: 470.1884. MS *m/z* (relative intensity): 470 (M^+, 100), 412 (5), 329 (32), 271 (18), 242 (16), 184 (31), 158 (23), 131 (22), 98 (21), 77 (73). IR ($CHCl_3$) cm^{-1}: 1633. ^{1}H-NMR δ: 0.94 (3H, t, $J=7.5$ Hz), 1.39—2.24 (4H, m), 1.63 (2H, tq, $J=7.5$, 7.5 Hz), 1.90 (1H, br s, OH), 2.01 (2H, tt, $J=6$, 6 Hz), 3.10—3.62 (4H, m), 3.62—3.97 (1H, m), 3.80 (2H, t, $J=6$ Hz), 4.12 (2H, t, $J=6$ Hz), 6.49 (1H, d, $J=3.5$ Hz), 6.61 (1H, d, $J=2.5$ Hz), 7.19—7.57 (5H, m), 7.72—7.99 (2H, m).

6-Hydroxy-4-(2-oxo-1-propyl-3-piperidyl)-1-(phenylsulfonyl)indole (43) Employing the Swern reagent as described above, **43** (17 mg, 92%) was obtained from **42** (21 mg, 0.0446 mmol). Colorless syrup. HRMS Calcd for $C_{22}H_{24}N_2O_4S$: 412.1455. Found: 412.1438. MS *m/z* (relative intensity): 412 (M^+, 100), 370 (12), 271 (86), 243 (14), 230 (16), 213 (14), 184 (33), 158 (35), 146 (16), 141 (8), 131 (23), 77 (85). IR ($CHCl_3$) cm^{-1}: 1615. ^{1}H-NMR δ: 0.93 (3H, t, $J=7.5$ Hz), 1.37—2.18 (6H, m), 3.17—3.58 (4H, m), 3.62—3.93 (1H, m), 6.27 (1H, d, $J=2$ Hz), 6.39 (1H, d, $J=3.5$ Hz), 7.12 (1H, d, $J=2$ Hz), 7.32 (1H, d, $J=3.5$ Hz), 7.17—7.49 (3H, m), 7.61—7.90 (2H, m).

6-Hydroxy-4-(1-propyl-3-piperidyl)indole (44) A solution of **43** (16 mg, 0.0388 mmol) in THF (3 ml) was refluxed with $LiAlH_4$ (15 mg, 0.395 mmol) under an Ar atmosphere for 5 h, then worked up as described for the synthesis of **34**. The residue was purified by Al_2O_3 PTLC [hexane–EtOAc (2 : 1)] to yield **44** (7.5 mg, 75%) as a colorless syrup. HRMS Calcd for $C_{16}H_{22}N_2O$: 258.1731. Found: 258.1703. MS *m/z*: (relative intensity): 258 (M^+, 61), 229 (100), 186 (6), 159 (18), 146 (14), 115 (11), 86 (54), 70 (31). ^{1}H-NMR δ: 0.82 (3H, t, $J=7.5$ Hz), 1.14—2.50 (10H, m), 2.89—3.47 (3H, m), 4.96 (1H, br s, OH), 6.43 (1H, br d, $J=3$ Hz), 6.54 (1H, br s), 6.65 (1H, br s), 6.88 (1H, br d, $J=3$ Hz), 8.10 (1H, br s, NH).

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