Tetrahedron Vol 45, No 6, pp 1653 to 1660, 1989
Printed in Great Britain

0040-4020/89 $3 00+ 00

TOTAL SYNTHESIS OF EUPOLAURAMINE[1]

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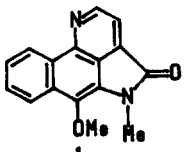
(*Received in Japan* 17 *November* 1988)

Abstract: A ten-step total synthesis of the title compound was accomplished in satisfactory yield. As a basis for the above synthesis, a facile preparation of 6-methoxybenzo[h]quinolines from the N-methoxyamide **8** was developed using the intramolecular trapping of a N-methoxy-N-acylnitrenium ion, the acid catalyzed regiospecific direct methoxylation, and the aromatization of dihydrocarbostyril moiety to quinoline moiety via thiolactam formation.

6-Methoxy-5-methylbenzo[h]pyrrolo[4,3,2-de]quinolin-4(5H)-one (eupolauramine)(**1**) is a structually unique azaphenanthrene alkaloid isolated from the bark of Eupomatia laurina by Taylor et al.[2] in 1972 and its structure was first established by X-ray crystallography.[3] Three groups[4] have already published the total synthesis of **1**.



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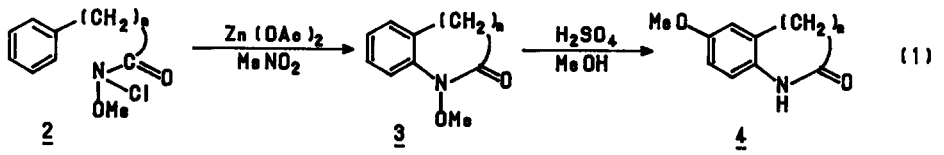
In recent efforts we have detailed a new synthesis of nitrogen-containing heterocyclic compounds bearing N-methoxy function[5] and the direct introduction of a methoxy group to the para-position of the methoxy amide function.[6] The merits



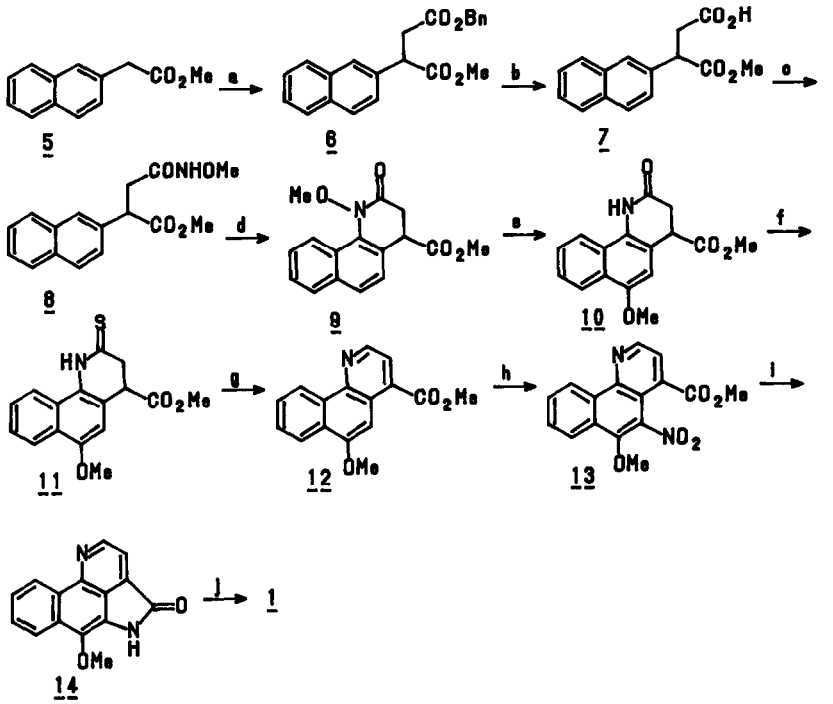
2 **3** **4** (1)

of these methods include high yields, short reaction times, cheap and easily handled reagents and technical simplicity. To test the feasibility of these methods, we chose the total synthesis of **1** and report here a full details of our successful synthetic approaches to **1** including a new method of aromatization of dihydrocarbostyril moiety in the presence of other functional groups to quinoline moiety.

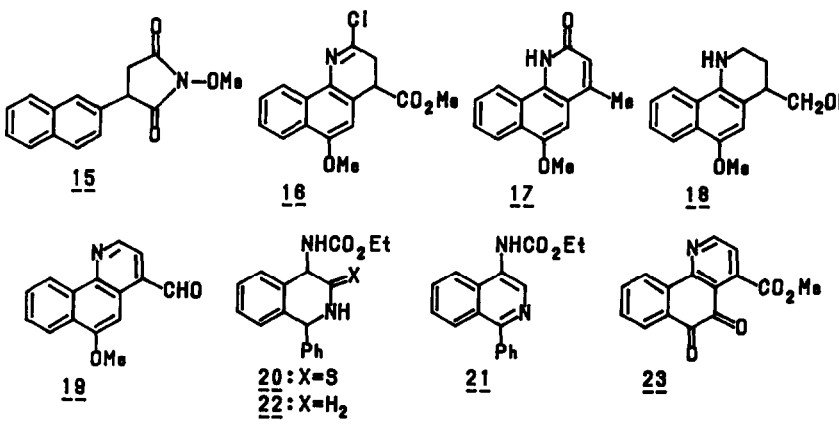
Results and Discussion

Our approach to **1** was based on the first construction of the benzo[h]quinoline skeleton having appropriate functionalization for subsequent manipulation to generate the lactam ring, as shown in Scheme I.

Scheme I[a]



[a]Reagents and Conditions: (a) $BrCH_2CO_2Bn$/LDA/THF/-78 °C/2 h (95%); (b) H_2/10% Pd-C/AcOEt/6 h (96%); (c) $MeONH_2 \cdot HCl$/WSC·HCl/1-hydroxybenzotriazole/Et_3N/$ClCH_2CH_2Cl$/rt/5 h (95%); (d) (1) tert-BuOCl/CH_2Cl_2/0 °C/15 min, (2) $Zn(OAc)_2$/$MeNO_2$/70 °C/7 min (88%); (e) c.H_2SO_4/MeOH/reflux/3 h (87%); (f) P_2S_5/pyridine/120 °C/45 min (96%);(g) Raney Ni/xylene/145 °C/9 h (84%); (h) $Cu(NO_3)_2$/ascorbic acid/Ac_2O/70 °C/10 h (69%); (i) H_2/10% Pd-C/DMF-MeOH/2.5 h (94%); (j) MeI/NaH/DMF/rt/0.5 h (97%).



The starting material for the synthesis was the commercially available methyl 2-naphthylacetate **5** which was monoalkylated with benzyl bromoacetate using LDA to give **6** in 96% yield. Debenzylation of **6** to **7** was performed by catalytic hydrogenation with 10% Pd-C. The acid **7** was condensed with methoxyamine in the presence of 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide (WSC) and 1-hydroxybenzotriazole in 1,2-dichloroethane to give **8** in 95% yield. In this reaction neutral condition was required, otherwise undesirable product **15** was exclusively obtained.

The cyclization of **8** to **9** *via* a N-chloride was one of the key steps of this synthesis and successfuly performed by our previously reported method.[5a] Thus, **8** was N-chlorinated with *tert*-butyl hypochlorite in CH_2Cl_2 to give the N-chloro-N-methoxyamide which was directly subjected to the cyclization reaction [$Zn(OAc)_2$/$MeNO_2$/70 °C/7 min] to yield regiospecifically the cyclized product **9** in 88% yield. The similar cyclization of **8** with Ag_2CO_3-CF_3CO_2H[5b] is also effective for the synthesis of **1**; however, the former method is applicable for large scale preparation because of simplicity of post-treatment.[5a] The structure of **9** was confirmed from the ^1H NMR spectra by the *ortho*-coupling of the two aromatic protons (H-5, H-6; J=8.1 Hz).

Regiospecific introduction of a methoxy group into the *para*-position of the N-methoxy function is also a key step of this synthesis. Treatment of **9** with a catalytic amount of concentrated H_2SO_4 in refluxing MeOH yielded exclusively **10** in 87% yield. This methoxylation proceeded intermolecularly and MeOH attacked the carbonium ion of C-6 produced by a cation shift from an initially formed nitrenium ion. The position of the methoxy group in **10** was confirmed from the ^1H NMR spectrum of **10**, which exhibited singlet at 6.92 ppm of H-5.

The next step, conversion of **10** into **12**, proved extraordinarily difficult to effect at first. Dehydrogenation of **10** with 10% Pd-C in refluxing decaline or diphenyl ether afforded decomposition to complex mixture and 2,3-dichloro-5,6-dicyano-1,4-benzoquinone (DDQ) oxidation of **10** led to the recovery of the starting material **10**. Attempted chlorination of **10** to **16** by $POCl_3$ or CCl_4/PPh_3 were also unsuccessful. The same kind of difficulty was reported by Taylor et al.[4b] in the conversion of 6-methoxy-4-methylbenzo[h]quinolinone (**17**) to the corresponding quinoline derivative.

Since we were unable to convert **10** to **12** in the desired manner, we next turned to another route. Thus, reduction of **10** with $LiAlH_4$ in refluxing tetrahydrofuran (THF) for 18 h gave an unstable alcohol **18** in 95% crude yield. Oxidation of **18** with manganese dioxide[7] in refluxing benzene for 23 h gave the aldehyde **19** in 55% yield. **19** was converted to **12** following the Taylor's method[4b] (yield, 95%). However, this route (**10** → **12**) gave a low overall yield (50%) and required long reaction time.

Therefore, our attention was focussed on a more efficient conversion of **10** to **12**. Tikk et al.[8] reported that **20** was treated with Raney Ni in refluxing EtOH to give the unexpected **21** instead of **22**. This reaction involved both desulfurization and simultaneous aromatization whose sequence was exactly fitted to our conversion of **10** to **12**. Therefore, we examined the desulfurization of **11**, which was easily synthesized from **10** with P_2S_5 in pyridine in 96% yield, with Raney Ni (W-2) in various solvents. The best result was obtained when xylene was used as a solvent.

Dioxane can also be effective in longer reaction time but N,N-dimethylformamide (DMF)-EtOH (1:1) and acetic anhydride gave poor results. Accordingly, the direct two steps conversion of **11** to **12** was accomplished by using Raney Ni in refluxing xylene for 9 h in 84% yield.

Table I Solvent Effects on the Aromatization of **11** with Raney Ni

Run	Solvent	Temp. (°C)	Time (h)	Yield of **12** (%)[a]
1	DMF-EtOH (1:1)	110	27	38
2	dioxane	120	48	77
3	xylene	145	9	84
4	Ac_2O	140	4	19

a) Isolated yields of pure product.

Although nitration of **12** was reported to be unsuccessful by Taylor et al.,[10] the nitration with $Cu(NO_3)_2/Ac_2O$ at 70 °C afforded the desired nitro compound **13** in 58% yield. The position of the nitro group was confirmed from ^1H NMR spectrum of **13** by the disappearance of the signal of H-5. In this reaction, a considerable amount (yield, 22%) of the quinone **23** was obtained as a side product. Its ^1H NMR spectrum shows no signal corresponding to 6-OMe or for 5-H. The quinone structure was confirmed from ^{13}C NMR spectrum by two carbony carbon peaks (δ178.67 and 179.17) in addition to the ester carbonyl carbon peak (δ167.46), IR spectrum (ketone absorption at 1685 cm^{-1}) and mass spectrum (M^+, 267). The formation of **23** presumably involves demethylation of 6-OMe and oxidation of the produced phenol to the ortho quinone **23**. When a 0.3 molar equivalent of ascorbic acid was added to the reaction mixture, the yield of **13** was increased from 58% to 68% and that of **23** was decreased from 22% to 10%. Another additives such as 2,4,6-tri-tert-butylphenol and $Cu(OAc)_2$ were also effective.

Table II Effects of the Additives on the Nitration of **12** with $Cu(NO_3)_2/Ac_2O$[a]

Run	Additive (equiv.)[b]	Yield (%)[c] **13**	**23**
1	none	58	22
2	ascorbic acid (0.3)	69	10
3	2,4,6-tri-tert-butylphenol (0.3)	69	26
4	$Cu(OAc)_2$ (0.1)	66	16

a) All reactions were performed at 70 °C for 9 h under an argon atmosphere. b) Equiv. refers to molar equivalents with respect to **12**. c) Isolated yields of pure products.

Catalytic hydrogenation of **13** with 10% Pd-C in DMF-MeOH afforded directly the cyclized N-demethyleupolauramine **14** in 94% yield. Methylation of **14** afforded eupolauramine **1**, identical with an authentic eupolauramine[1,9] in mp, IR, MS, and ^1H NMR. The overall yield in ten steps from **5** was 34%.

EXPERIMENTAL

General. All melting points were determined with a Yanagimoto hot-stage melting point apparatus and were uncorrected. IR spectral measurements were carried out with a JASCO IR810 spectrometer. ^{1}H NMR spectra were measured on either a JEOL JNM-PMX60SI or a JEOL JNM-FX270 spectrometer. ^{13}C NMR spectra were obtained on a JEOL JNM-FX270 spectrometer (at 67.8 MHz). All signals in both ^{1}H and ^{13}C NMR spectra were expressed as ppm downfield from tetramethylsilane used as an internal standard (δ-value). Low- and high-resolution mass spectra were obtained with a JEOL JMS-DX300 spectrometer with a direct inlet system at 70 eV. Microanalyses were carried out in the microanalytical laboratory of this university.

Benzyl 3-Methoxycarbonyl-3-(2-naphthyl)propionate (6). Prepared from 5[10] and benzyl bromoacetate[11] in 95% yield according to the reported procedure[12]. Colorless oil. IR(neat) 1730 cm^{-1}; ^{1}H NMR ($CDCl_3$, 270 MHz) δ 2.84 (dd, 1H, J=5.9, 16.9 Hz), 3.35 (dd, 1H, J=9.5, 16.9 Hz), 3.65 (s, 3H), 4.28 (dd, 2H, J=5.9, 9.5 Hz), 5.10 (s, 1H), 5.12 (s, 1H), 7.27-7.33 (m, 5H), 7.40 (dd, 1H, J=1.8, 8.8 Hz), 7.45-7.51 (m, 2H), 7.72 (d, 1H, J=1.8 Hz), 7.77-7.84 (m, 3H); Mass m/e: 348 (M^+). Exact Mass: Calcd. for $C_{22}H_{20}O_4$: 348.1361. Found: 348.1365.

3-Methoxycarbonyl-3-(2-naphthyl)propionic Acid (7). A mixture of 6 (17.4 g, 50 mmol) and 10% Pd-C (1 g) in EtOAc (150 ml) was stirred under a hydrogen atmosphere at room temperature for 6 h. The mixture was filtered and the filtrate was concentrated in vacuo to give pure 7 as colorless crystals (12,4 g, 96%). An analytical sample was obtained by recrystallization from EtOAc-hexane, mp 141-143 °C. IR (nujol) 3600-2400 (br), 1730, 1700 cm^{-1}; ^{1}H NMR ($CDCl_3$, 270 MHz) δ 2.81 (dd, 1H, J=5.1, 17.2 Hz), 3.37 (dd, 1H, J=9.9, 17.2 Hz), 3.69 (s, 3H), 4.24 (dd, 1H, J=5.1, 9.9 Hz), 7.40 (dd, 1H, J=1.8, 8.8 Hz), 7.45-7.53 (m, 2H), 7.74 (d, 1H, J=1.8 Hz), 7.78-7.86 (m, 3H); Mass m/e: 258 (M^+). Anal. Calcd. for $C_{15}H_{14}O_4$: C, 69.76; H, 5.46%. Found: C, 69.59; H, 5.50%.

Methyl 2-(N-Methoxycarbamoylmethyl)-2-(2-naphthyl)acetate (8). A mixture of 7 (10 g, 38.8 mmol), methoxyamine hydrochloride (3.88g, 46.5 mmol), Et_3N (10.9 ml, 77.5 mmol), 1-hydroxybenzotriazole (6.53 g, 42.4 mmol), and WSC hydrochloride (8.17 g, 42.6 mmol) in $ClCH_2CH_2Cl$ (150 ml) was stirred for 5.5 h at room temperature. The mixture was then diluted with CH_2Cl_2 (150 ml) and H_2O (100 ml). The organic layer was separated and washed successively with 5% HCl (100 ml), H_2O (100 ml), 3% $NaHCO_3$ (100 ml), and H_2O (2x100 ml). The organic solution was dried over Na_2SO_4 and concentrated in vacuo to give pure 8 as colorless crystals (10.6 g, 95%). An analytical sample was obtained by recrystallization from CH_2Cl_2-hexane, mp 103-105 °C. IR(nujol) 3200, 1730, 1650 cm^{-1}; ^{1}H NMR ($CDCl_3$, 270 MHz) δ 2.40-2.60 (m, 1H), 2.85-3.10 (m, 1H), 3.68 (s, 3H), 4.37 (dd, 2H, J=5.1, 9.9 Hz), 7.35-7.43 (br, 1H), 7.45-7.52 (m, 2H), 7.74 (br s, 1H), 7.78-7.85 (m, 3H), 8.27 (br s, 1H); CI Mass m/e: 288 (M^++1). Anal. Calcd. for $C_{16}H_{17}NO_4$: C, 66.88; H, 5.96; N, 4.88%. Found: C, 66.65; H, 5.89; N, 4.66%.

1-Methoxy-3-(2-naphthyl)-2,5-pyrrolidinedione (15). Methyl 2-chloroformylmethyl-2-(2-naphthyl)acetate (1.07 g, 3.88 mmol), prepared from 7 and thionyl chloride, was added to a vigorously stirred solution of methoxyamine hydrochloride (0.36 g, 4.31 mmol) and sodium carbonate (0.82 g, 7.74 mmol) in a mixture of benzene (5 ml) and H_2O (4.5 ml) with cooling. The reaction mixture was stirred for 5 h at room

temperature and then extracted with EtOAc (2x30 ml). The combined extracts were washed with brine (25 ml), dried over Na_2SO_4, filtered, and concentrated under reduced pressure. The residue was recrystallized from EtOAc-hexane to give **15** (0.87 g, 88%), mp 179-180 °C. IR (nujol) 1708 cm^{-1}; ^1H NMR (DMSO-d_6, 60 MHz) δ 2.78 (dd, 1H, J=7.6, 18.0 Hz), 3.28 (dd, 1H, J=9.6, 18.0 Hz), 3.87 (s, 3H), 4.33 (dd, 1H, J=7.6, 9.6 Hz), 7.23-7.67 (m, 3H), 7.67-8.00 (m, 4H); Mass m/e: 255 (M^+). Anal. Calcd. for $C_{15}H_{13}NO_3$: C, 70.58; H, 5.13; N, 5.49%. Found: C, 70.69; H, 5.25; N, 5.32%.

Methyl 1-Methoxy-2-oxo-1,2,3,4-tetrahydrobenzo[h]quinoline-4-carboxylate (9). To a stirred solution of **8** (10.53 g, 36.7 mmol) in CH_2Cl_2 (100 ml), tert-butyl hypochlorite (5.0 ml, 44.0 mmol) was added with cooling. After 20 min, the solvent was evaporated to dryness in vacuo. The residue dissolved in nitromethane (30 ml) was added to a stirred suspension of zinc acetate (33.62 g, 183.3 mmol) in nitromethane (310 ml) preheated at 70 °C. After 7 min, insoluble materials were filtered off and washed with EtOAc (250 ml). The combined solvents were concentrated under reduced pressure and the residue was dissolved in EtOAc (250 ml), which was washed with 5% $NaHCO_3$ (150 ml), brine (2x100 ml) and dried over Na_2SO_4. After evaporation of the solvent, the residue was chromatographed on a column of silica gel with EtOAc-hexane (3:1) as the eluent to give **9** (9.19 g, 88%), 128-130 °C (Et_2O). IR (nujol) 1730, 1690 cm^{-1}; ^1H NMR ($CDCl_3$, 270 MHz) δ 2.99 (dd, 1H, J=5.9, 15.7 Hz), 3.09 (dd, 1H, J=3.3, 15.7 Hz), 3.65 (s, 3H), 3.73 (s, 3H), 3.92 (dd, 1H, J=3.3, 5.9 Hz), 7.37 (d, 1H, J=8.1 Hz), 7.52 (t, 1H, J=6.8 Hz), 7.53 (t, 1H, J=6.8 Hz), 7.68 (d, 1H, J=8.1 Hz), 7.84 (dd, 1H, J=3.6, 6.2 Hz), 8.66 (dd, 1H, J=3.6, 6.2 Hz); Mass m/e: 285 (M^+). Anal. Calcd. for $C_{16}H_{15}NO_4$: C, 67.36; H, 5.30; N, 4.91%. Found: C, 67.37; H, 5.47; N, 4.84%.

Methyl 6-Methoxy-2-oxo-1,2,3,4-tetrahydrobenzo[h]quinoline-4-carboxylate (10). A solution of **9** (5.63 g, 19.7 mmol) and concentrated H_2SO_4 (9.98 g, 98.5 mmol) in MeOH (280 ml) was refluxed for 3 h. The solvent was then concentrated to a 30 ml volume under reduced pressure and the residue was diluted with an ice-water (100 ml). The precipitated solid was collected and washed with a cold water (3x20 ml) and hexane (20 ml) to give a pure **10** (4.91 g, 87%) as colorless crystals. An analytical sample was obtained by recrystallization from MeOH, mp 263-265 °C. IR (nujol) 3275, 1740, 1670 cm^{-1}; ^1H NMR (DMSO-d_6, 270 MHz) δ 2.75 (dd, 1H, J=2.7, 15.9 Hz), 2.87 (dd, 1H, J=6.7, 15.9 Hz), 3.61 (s, 3H), 3.95 (s, 3H), 4.14 (dd, 1H, J=2.7, 6.7 Hz), 6.92 (s, 1H), 7.50-7.58 (m, 2H), 8.14 (d, 1H, J=7.9 Hz), 8.27 (d, 1H, J=7.9 Hz), 10.23 (br s, 1H); Mass m/e: 285 (M^+). Anal. Calcd. for $C_{16}H_{15}NO_4$: C, 67.36; H, 5.30; N, 4.91%. Found: C, 67.36; H, 5.42; N, 4.77%.

6-Methoxybenzo[h]quinoline-4-carbaldehyde (19). A mixture of **10** (1.21 g, 4.2 mmol) and $LiAlH_4$ (0.65 g, 17.0 mmol) in dry THF (60 ml) was refluxed for 18 h using a Soxhlet extractor. After the usual workup, the resultant crude product (0.98 g, 95%) was used in the next reaction without purification. IR (neat) 3275, 3200 cm^{-1}; ^1H NMR ($CDCl_3$, 60 MHz) δ 1.67-2.27 (m, 3H), 2.77-3.67 (m, 4H), 3.67-4.13 (m, 1H), 3.72 (s, 1H), 3.80 (s, 3H), 6.55 (s, 1H), 7.17-7.77 (m, 3H), 8.00-8.28 (m, 1H); Mass m/e: 237 (M^+). The mixture of crude **18** (0.98g, 4.0 mmol) and MnO_2 (3.69 g, 42.4 mmol) in dry benzene (70 ml) was refluxed for 23 h under an argon atmosphere. The solution was filtered through Celite and the filtrate was concentrated under reduced pressure. The residue was purified by column

chromatography on silica gel eluting with CH_2Cl_2-MeOH (100:1) to give **21** (525.7 mg, 55%), mp 146-148 °C (CH_2Cl_2-hexane)(lit.[4b] mp 142-143 °C). The spectra match literature data.[4b]

Methyl 6-Methoxy-2-thioxo-1,2,3,4-tetrahydrobenzo[h]quinoline-4-carboxylate (11). A solution of **10** (2.85 g, 10 mmol) and P_2S_5 (0.25 g, 11 mmol) in dry pyridine (50 ml) was heated at 120 °C for 40 min under an argon atmosphere. The solution was concentrated under reduced pressure and the residue was diluted with cold water (60 ml). The precipitated solid was collected, washed with cold water (3x20 ml) and recrystallized from EtOH to give **11** (2.88 g, 96 %), mp 170-171 °C. IR (nujol) 3180, 1735 cm^{-1}; ^1H NMR ($CDCl_3$, 270 MHz) δ 3.21 (dd, 1H, J=7.0, 16.8 Hz), 3.69 (dd, 1H, J=3.7, 16.8 Hz), 3.72 (s, 3H), 3.95 (dd, 1H, J=3.7, 7.0 Hz), 4.02 (s, 3H), 6.72 (s, 1H), 7.55-7.64 (m, 2H), 7.82 (br d, 1H, J=8.4 Hz), 8.31 (br d, 1H, J=8.4 Hz), 8.87+9.80 (br s, 1H, D_2O changeable); Mass m/e: 301 (M^+). Anal. Calcd. for $C_{16}H_{15}NO_3S$: C, 63.77; H, 5.02; N, 4.65%. Found: C, 63.91; H, 5.24; N, 4.37%.

Methyl 6-Methoxybenzo[h]quinoline-4-carboxylate (12). A mixture of **11** (1.95 g, 6.5 mmol) and Raney Ni (W-2)(12 g) in dry xylene (50 ml) was heated at 145 °C for 9 h under an argon atmosphere. The solution was then filtered through Celite and the filtrate was concentrated under reduced pressure. The residue was purified by column chromatography on silica gel eluting with EtOAc-hexane (1:3) to give **12** (1.45 g, 84%), mp 137-139 °C (lit.[4b] mp 136-137 °C). The spectra match literature data.[4b]

Methyl 6-Methoxy-5-nitrobenzo[h]quinoline-4-carboxylate (13) and Methyl Benzo[h]quinoline-5,6-dione-4-carboxylate (23). To a stirred solution of **12** (1 g, 3.8 mmol) and ascorbic acid (0.2 g, 1.1 mmol) in Ac_2O (freshly distilled from P_2O_5)(35 ml) at 70 °C was added $Cu(NO_3)_2 \cdot 3H_2O$ (7x260 mg, total 7.6 mmol) in seven portions at 1 h intervals; during that time argon was bubbled through the solution. After 9 h in total, the mixture was cooled in an ice bath and diluted with H_2O (300 ml). After stirring at room temperature for 0.5 h, the mixture was extracted with EtOAc (2x150 ml). The combined extracts were washed with 5% Na_2SO_4 (3x120 ml) and brine (2x120 ml) and dried over Na_2SO_4. After evaporation of the solvent, the residue was purified by column chromatography on silica gel. First elution with EtOAc-hexane (1:3) afforded **13** (811 mg, 69%) as yellow needles, mp 188-189 °C (EtOAc-hexane). IR (nujol) 1730 cm^{-1}; ^1H NMR ($CDCl_3$, 270 MHz) δ 3.96 (s, 3H), 4.24 (s, 3H), 7.26-7.95 (m, 2H), 7.85 (d, 1H, J=4.4 Hz), 8.28-8.32 (m, 1H), 9.08 (d, 1H, J=4.4 Hz), 9.36-9.39 (m, 1H); Mass m/e: 312 (M^+). Anal. Calcd. for $C_{16}H_{12}N_2O_5$: C, 61.54; H, 3.87; N, 8.97%. Found: C, 61.53; H, 3.93; N, 8.99%. Second elution with EtOAc-hexane (1:2) afforded **23** (97.6 mg, 9.8%) as colorless crystals, mp 181-183 °C (AcOEt-hexane). IR (nujol) 1725, 1685 cm^{-1}; ^1H NMR ($CDCl_3$, 270 MHz) δ 4.01 (s, 3H), 7.33 (d, 1H, J=5.1 Hz), 7.61 (ddd, 1H, J=1,5, 7.7, 7.7 Hz), 7.81 (ddd, 1H, J=1.5, 7.7, 7.7 Hz), 8.18 (dd, 1H, J=1.5, 7.7 Hz), 8.70 (dd, 1H, J=1.5, 7.7 Hz), 8.92 (d, 1H, J=5.1 Hz); ^{13}C NMR ($CDCl_3$, 67.8 MHz) δ 53.49 (q), 121.91 (d), 122.91 (d), 126.89 (d), 129.89 (d), 131.25 (s), 131.69 (s), 136.10 (s), 1347 (d), 143.45 (s), 154.08 (s), 155.33 (d), 167.46 (s), 178.67 (s), 179.17 (s); Mass m/e: 267 (M^+). Anal. Calcd. for $C_{15}H_9NO_4$: C, 67.41; H, 3.39; N, 5.24%. Found: C, 67.27; H, 3.53; N, 5.23.

6-Methoxybenzo[h]pyrrolo[4,3,2-de]quinolin-4(5H)-one (14). A mixture of **13** (110

mg, 0.4 mmol) and 10% Pd-C (20 mg) in MeOH (6 ml)-DMF (4 ml) was stirred under a hydrogen atmosphere at room temperature for 2.5 h. THe mixture was then filtered and the filtrate was concentrated under reduced pressure. The residue was diluted with toluene (10 ml) and the solution was again concentrated. The crude product was purified by a short column chromatography on silica gel eluting with CH_2Cl_2-MeOH (25:1) to give **14** (82.9 mg, 94%), mp 295-297 °C (MeOH)(lit.[4b,13] mp 300-304 °C). The spectra match literature data.[4b]

6-Methoxy-5-methylbenzo[h]pyrrolo[4,3,2-de]quinolin-4(5H)-one (Eupolauramine)(1). Prepared from **14** in 97% yield according to the reported procedure[4b]. Mp 189-190 °C (lit.[4b] mp 190-191 °C). The spectra match literature data.[4b,9]

REFERENCES AND NOTES

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