A Convenient Route to New Phenyltetrahydroindolizines

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Synthesis of new 6-(4-chlorophenyl)-5,6,7,8-tetrahydroindolizines was achieved starting from 4-amino-3-(4-chlorophenyl)butyric acid (Baclofen). The chemical pathway, involving a Clauson-Kaas reaction and a subsequent cyclization, led to an iminium salt whose reactivity was studied.

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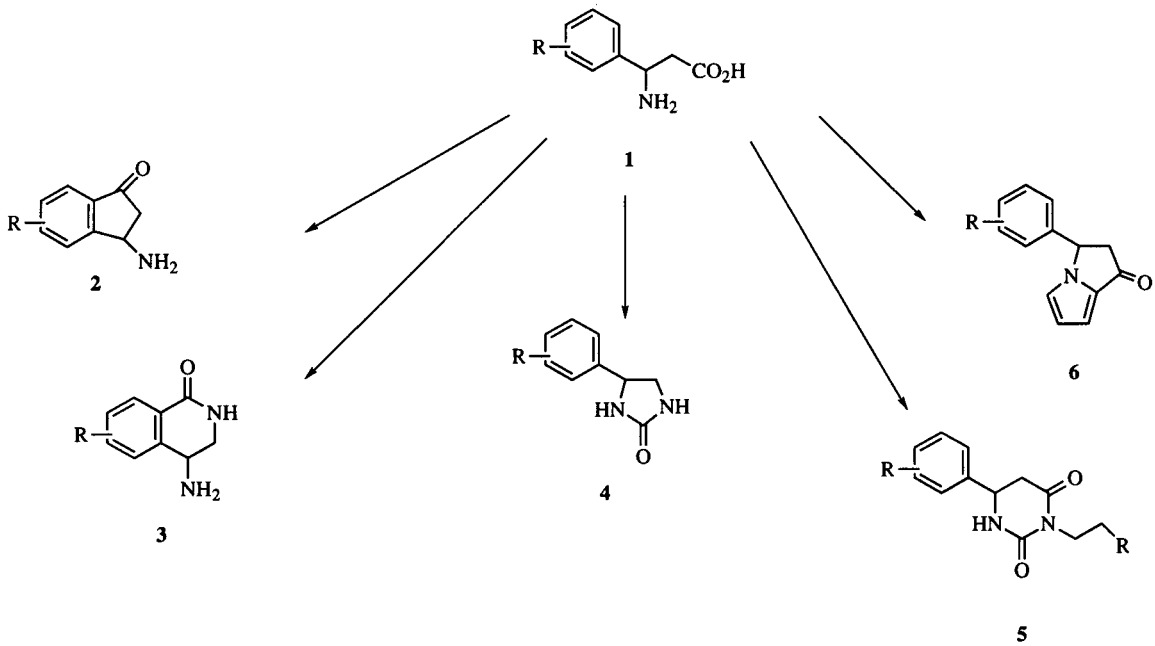
We have demonstrated for several years the interest in the 3-amino-3-phenylpropionic acids **1** as building blocks in the synthesis of new cyclic systems with potential therapeutic interest such as aminoindanones **2** [1], aminoisoquinolones **3** [2], phenylimidazolidinones **4** [3], phenylhexahydropyrimidinediones **5** [4] and phenylpyrrolizinones **6** [5] (Scheme 1).

In continuation of this work, we have recently undertaken the study of the chemical reactivity of higher homologous aminoacids and especially 4-amino-3-(4-chlorophenyl)butyric acid (Baclofen) **7** (Scheme 2). We wish to describe herein the use of the latter as a synthetic route to new 6-(4-chlorophenyl)-5,6,7,8-tetrahydroindolizines.

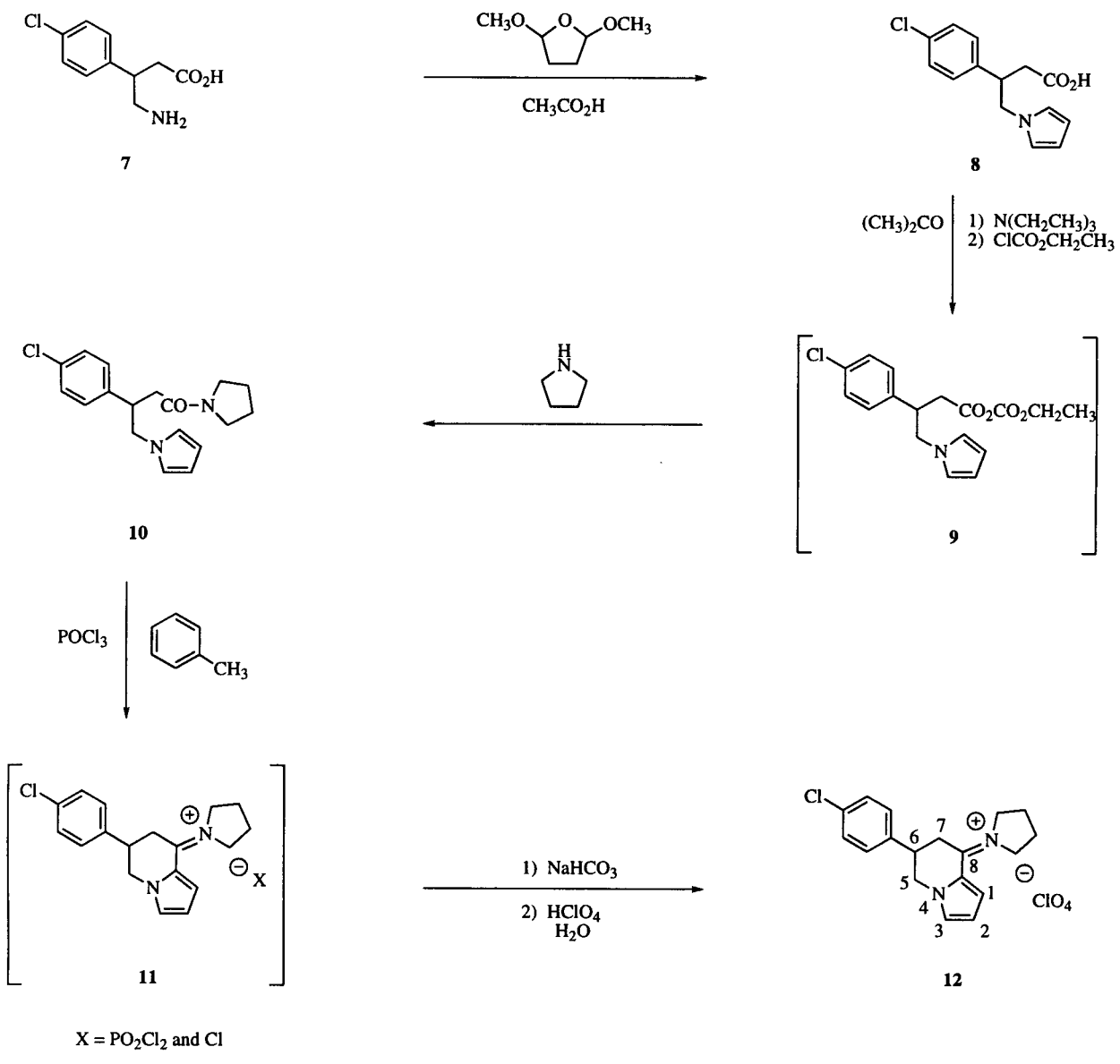
Baclofen **7**, involved in a Clauson-Kaas reaction [6,7] using 2,5-dimethoxytetrahydrofuran in acetic acid, led to 3-(4-chlorophenyl)-4-pyrrol-1-ylbutyric acid **8** in good yield. Treatment of **8** in acetone with triethylamine and ethyl chloroformate yielded the mixed anhydride **9** which was immediately refluxed without isolation in the presence of pyrrolidine to give the amide **10**.

Cyclization of **10** was then achieved by treatment with phosphoryl chloride in refluxing toluene, as described for the synthesis of phenylpyrrolizines [5]. The reaction afforded a Vilsmeier salt **11**: a mixture of iminium chloride and phosphonodichloridate. This unstable mixture was quickly dissolved in boiling water and, after cooling, the aqueous solution was then brought to alkaline *p*H with

Scheme 1



Scheme 2



X = PO_2Cl_2 and Cl

sodium hydrogen carbonate.

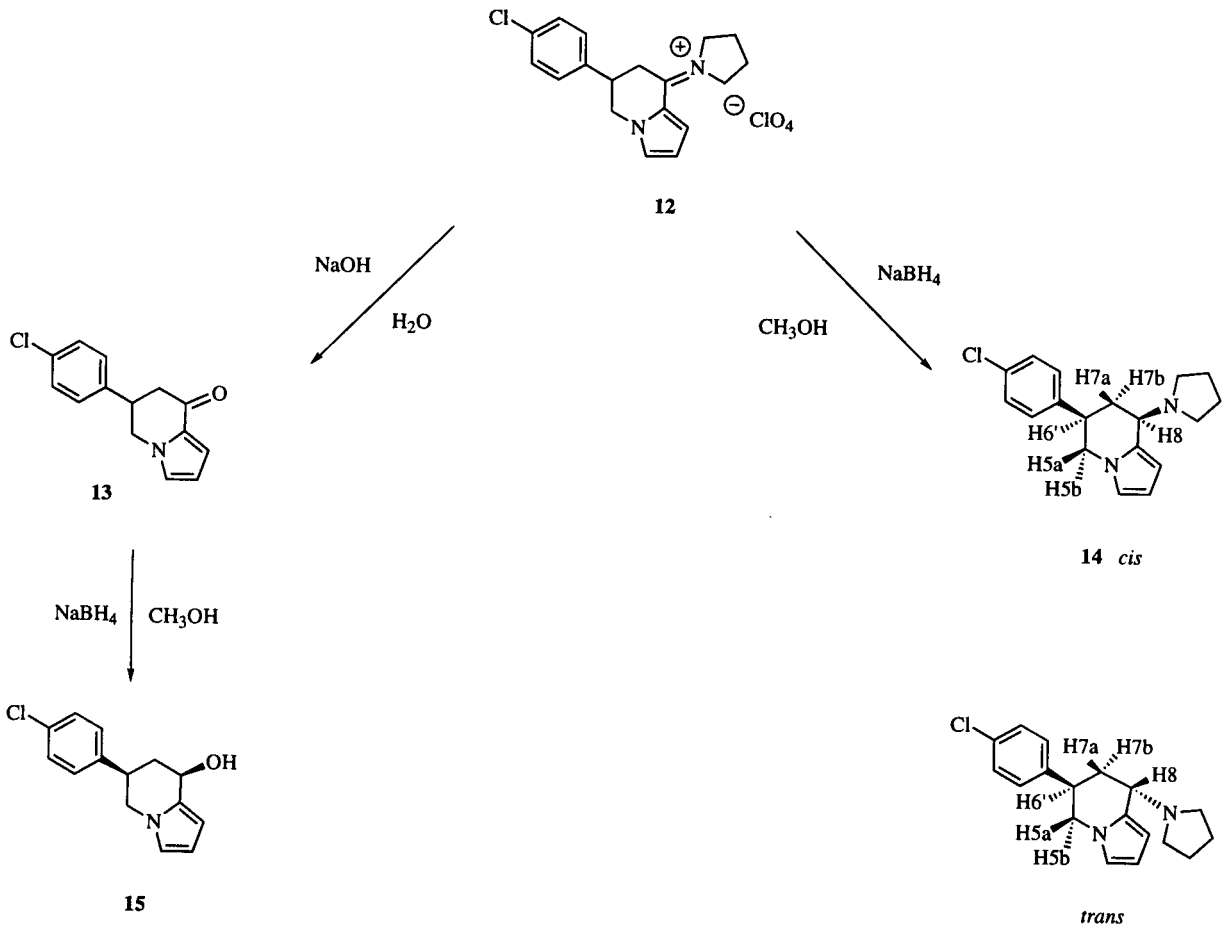
Final acidification of the reaction mixture with perchloric acid gave the formation of the iminium perchlorate **12** which precipitated from the aqueous solution in 90% yield from **8**.

The reactivity of this stable salt was evaluated. Its hydrolysis took place in sodium hydroxide solution at 60° and led to 6-(4-chlorophenyl)-5,6,7,8-tetrahydroindolizin-8-one **13** (Scheme 3).

Hydrogenation of **12** and **13** was accomplished at room temperature in methanol using sodium borohydride and led to pyrrolidinoindolizine **14** and to hydroxyindolizine **15** respectively.

The ^{1}H-nmr spectra of **14** and **15** revealed the presence of only one isomer. The analysis of the spectrum of **14** permitted us to establish the structure. The coupling constants for the signals of H-5, H-6, H-7 and H-8 were correlated with those we have recently reported for similar systems [8]. The signal of H-8 (4.07 ppm) appeared as a double doublet exhibiting *cis* (12 Hz) and *trans* (4 Hz) couplings. One H-5 appeared at 4.18 ppm as a double doublet with *gem* (12 Hz) and *trans* (4 Hz) couplings. The signal of the other H-5 (3.78 ppm) was a triplet due to the same value (12 Hz) of the two coupling constants *(gem* and *cis)*. We assigned 5a to the more deshielded signal corresponding to the H-5 proton which was in a *cis* rela-

Scheme 3



tionship with the phenyl ring. The signal of H-7b (1.91 ppm), in a *trans* position towards the phenyl ring, was a quartet showing three coupling constants of same value (12 Hz). These data indicated a system with one *gem* and two *cis* constants which favored a *cis* structure for **14**. Furthermore, the signal of H-7a (2.08 ppm) appeared as a multiplet different from the signal of H-7b, excluding a *trans* structure in which signals of both H-7 protons would be the same. From these data we also assigned a *cis* structure for the indolizinol **15**.

The reactivity of the iminium perchlorate **12** was also evaluated towards various amines (Scheme 4). For example, treatment of **12** in methanol with an ammonia gas flow, followed by a reduction with sodium borohydride afforded 8-amino-6-(4-chlorophenyl)-5,6,7,8-tetrahydroindolizine **16**. The latter was acidified with hydrochloric or oxalic acids to provide the hydrochloride **17** and the oxalate **18**, respectively. The free base **16** and the imine **19** were not isolated.

On the other hand, treatment of **12** with benzylamine and potassium carbonate in dimethylformamide led to the imine **20** which was reduced with sodium borohydride to give the free base **21** acidified to provide its hydrochloride **22**. The analysis of the ^{1}H-nmr spectra of **17**, **18**, **21** and **22** allowed us to establish *cis* structures for all of these compounds.

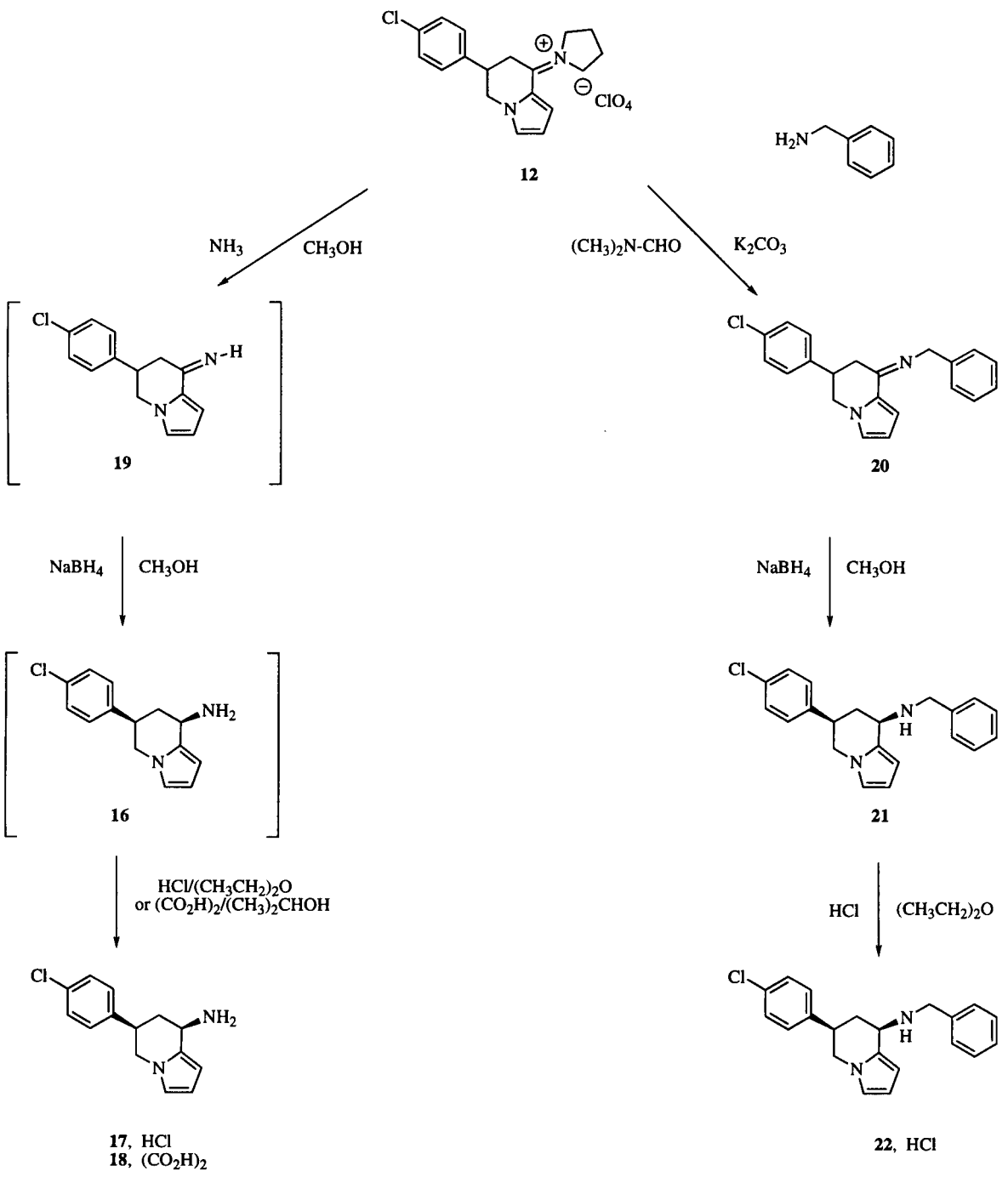
Further investigations on these products and related compounds are in progress.

EXPERIMENTAL

General Methods.

Melting points were taken on a Köfler bank and are uncorrected. Infrared spectra were recorded on a Philips PU 9716 apparatus. The nmr spectra were recorded on a Jeol JNM-LA 400 in DMSO-d_6 or deuteriochloroform solutions using TMS as an internal standard. Chemical shifts are reported in ppm downfield (δ) from TMS.

Scheme 4



3-(4-Chlorophenyl)-4-(pyrrol-1-yl)butyric Acid **8**.

To a solution of **7** (5 g, 0.0023 mole) in acetic acid (50 ml) was added 2,5-dimethoxytetrahydrofuran (3 ml, 0.023 mole). The reaction mixture was refluxed for 1 hour and then evaporated to dryness. The residue was taken up in ether (100 ml) and filtered. The filtrate was evaporated under reduced pressure to give **8** as white crystals (5 g, 82%), mp 136° (water); ir (potassium bromide): 3200-2400 (OH), 1700 (CO); ^{1}H-nmr (DMSO-d_6): 7.31 (d, J H-3' H-2' = 7.5 Hz, H-3' and H-5'), 7.23 (d, J H-2' H-3' = 7.5 Hz, H-2' and H-6'), 6.59 (m, 2H α-pyrrole), 5.90 (m, 2H β-pyrrole), 4.05 (m, H-4a and H-4b), 3.44 (m, H-3), 2.50 (m, H-2a and H-2b).

Anal. Calcd. for $C_{14}H_{14}NO_2Cl$: C, 63.76; H, 5.35; N, 5.31. Found: C, 63.74; H, 5.27; N, 5.09.

N-(3-(4-Chlorophenyl)-4-(pyrrol-1-yl)butyryl)pyrrolidine **10**.

To a stirred solution of **8** (5 g, 0.019 mole) in acetone (100 ml) at 0°, was added dropwise triethylamine (2.6 ml, 0.019 mole). After 30 minutes ethyl chloroformate (1.8 ml, 0.019 mole) was added dropwise at 0°. After 30 minutes pyrrolidine (1.2 ml, 0.019 mole) was added dropwise at 0° and then the reaction mixture was refluxed for 1 hour. The precipitate which formed was filtered and the filtrate was evaporated to dryness under reduced pressure. The oily residue was dissolved in ether (150 ml) and the solution was washed with water (2 x 100 ml). The organic layers were collected, dried over magnesium sulfate, filtered and the solvent was removed under reduced pressure to give **10** (6 g, 100%) as white crystals which were used without other purification: mp 87°; ir (potassium bromide): 1620 (CO); ^{1}H-nmr (DMSO-d_6): 7.28 (d, J H-3' H-2' = 7.5 Hz, H-3' and H-5'), 7.22 (d, J H-2' H-3' = 7.5 Hz, H-2' and H-6'), 6.56 (m, 2H α-pyrrole), 5.89 (m, 2H β-pyrrole), 4.08 (m, H-4a and H-4b), 3.53 (m, H-3), 3.22 (m, $2CH_2$ α-pyrrolidine), 2.53 (m, H-2a and H-2b), 1.72 (m, $2CH_2$ β-pyrrolidine).

N-(6-(4-Chlorophenyl)-5,6,7,8-tetrahydroindolizin-8-yl)pyrrolidinium Perchlorate **12**.

Phosphoryl chloride (4.2 ml, 0.044 mole) was added to a solution of **10** (7 g, 0.0022 mole) in toluene (100 ml). The reaction mixture was refluxed for 2 hours and then evaporated to dryness. The oily residue was washed with petroleum ether (2 x 100 ml) and then poured into water (60 ml). The mixture was then refluxed for another 60 minutes and filtered. The filtrate was cooled and adjusted to *p*H = 9 with sodium hydrogen carbonate. Perchloric acid was then added to acidify the solution to *p*H = 2. The precipitate was filtered, washed with water (50 ml) and dried to give **12** as white crystals (7.9 g, 90%): mp 110° (methanol); ir (potassium bromide): 1600 (CN), 1100 (ClO_4); ^{1}H-nmr (DMSO-d_6): 7.71 (m, H-3), 7.47 (m, 4H-ϕ and H-1), 6.66 (m, H-2), 4.53 (dd, J H-5a H-5b = 12 Hz, J H-5a H-6 = 4 Hz, H-5a), 4.18 (t, J H-5b H-5a = 12 Hz, J H-5b H-6 = 12 Hz, H-5b), 4.05 (m, H-6), 3.97 (m, $2CH_2$ α-pyrrolidine), 3.61 (dd, J H-7a H-7b = 17 Hz, J H-7a H-6 = 4 Hz, H-7a), 3.31 (br, H-7b), 2.10 (m, $2CH_2$ β-pyrrolidine); ^{13}C-nmr (DMSO-d_6): 160.6 (C-8), 138.4 (C-1'), 133.4 (C-8a), 132.2 (C-4'), 129.4 (C-2' and C-6'), 128.7 (C-3' and C-5'), 123.1 (C-3), 121.7 (C-1), 113.1 (C-2), 55.1 (C-5), 53.6 (C-7), 49.7 (C-6), 37.9 and 35.8 (2C α-pyrrolidine), 25.2 and 23.8 (2C β-pyrrolidine).

Anal. Calcd. for $C_{18}H_{20}N_2O_4Cl_2$: C, 54.14; H, 5.04; N, 7.01. Found: C, 54.47; H, 5.06; N, 6.94.

6-(4-Chlorophenyl)-5,6,7,8-tetrahydroindolizin-8-one **13**.

A suspension of **12** (10 g, 0.025 mole) in an aqueous solution of sodium hydroxide (2*N*, 50 ml) was heated at 60° for 2 hours. The cooled reaction mixture was then extracted with dichloromethane (2 x 100 ml). The organic layers were collected, washed with water (100 ml), dried over calcium chloride and evaporated to dryness under reduced pressure to give **13** as white crystals (3 g, 49%), mp 113° (ether/petroleum ether); ir (potassium bromide): 1645 (CO); ^{1}H-nmr (deuteriochloroform): 7.33 (d, J H-3' H-2' = 7.5 Hz, H-3' and H5'), 7.22 (d, J H- 2' H-3' = 7.5 Hz, H-2' and H-6'), 7.06 (m, H-3), 6.88 (m, H-1), 6.30 (m, H-2), 4.32 (dd, J H-5a H-5b = 12 Hz, J H-5a H-6 = 4 Hz, H-5a), 4.12 (t, J H-5b H-5a = 12 Hz, J H-5b H-6 = 12 Hz, H-5b), 3.62 (m, H-6), 2.80 (m, H-7a and H-7b); ^{13}C-nmr (deuteriochloroform) 185.9 (C-8), 138.4 (C-1'), 133.4 (C-8a), 130.1 (C-4'), 129.2 (C-2' and C-6'), 128.4 (C3' and C-5'), 126.1 (C-3), 114.3 (C-1), 111.0 (C-2), 51.0 (C-5), 43.0 (C7), 40.5 (C-6).

Anal. Calcd. for $C_{14}H_{12}NOCl$: C, 68.44; H, 4.98; N, 5.70. Found: C, 68.70; H, 5.25; N. 5.81.

cis 6-(4-Chlorophenyl)-8-(pyrrolidin-1-yl)-5,6,7,8-tetrahydroindolizine **14**.

Sodium borohydride (0.2 g, 0.005 mole) was added portionwise to a stirred solution of **12** (1 g, 0.0025 mole) in methanol (20 ml). The reaction mixture was stirred at room temperature for 2 hours and then evaporated to dryness under reduced pressure. The solid residue was dissolved in water (30 ml) and the solution was extracted twice by dichloromethane (2 x 50 ml). The organic layers were collected, dried over calcium chloride and the solvent was removed under reduced pressure to give **14** as a yellow oil (0.3 g, 40%); ^{1}H-nmr (DMSO-d_6): 7.40 (m, 4H-ϕ), 6.58 (m, H-3), 6.00 (m, H-1), 5.96 (m, H-2), 4.18 (dd, J H-5a H-5b = 12 Hz, J H-5a H-6 = 4 Hz, H-5a), 4.07 (dd, J H-8 H-7b = 12 Hz, J H-8 H-7a = 4 Hz, H-8), 3.78 (t, J H-5b H-5a = 12 Hz, J H-5b H-6 = 12 Hz, H-5b), 3.18 (m, H-6), 2.68 (m, $2CH_2$ α-pyrrolidine), 2.08 (m, H-7a), 1.91 (q, J H-7b H-7a = 12 Hz, J H-7b H-6 = 12 Hz, J H-7b H-8 = 12 Hz, H-7b), 1.69 (m, $2CH_2$ β-pyrrolidine); ^{13}C-nmr (DMSO-d_6): 141.8 (C-1'), 131.4 (C-4'), 130.0 (C-8a), 129.3 (C-2' and C-6'), 128.5 (C-3' and C-5'), 118.7 (C-3), 107.6 (C-1), 105.0 (C-2), 55.2 (C8), 50.8 (C-5), 47.6 (2C α-pyrrolidine), 39.4 (C-7), 29.1 (C-6), 23.7 (2C β-pyrrolidine).

Anal. Calcd. for $C_{18}H_{21}N_2Cl$: C, 71.86; H, 7.03; N, 9.31. Found: C, 71.91; H, 6.80; N. 9.50.

cis 6-(4-Chlorophenyl)-5,6,7,8-tetrahydroindolizin-8-ol **15**.

Sodium borohydride (0.16 g, 0.004 mole) was added portionwise to a stirred solution of **13** (1 g, 0.004 mole) in methanol (30 ml). The reaction mixture was stirred at room temperature for 1 hour and the solvent was removed under reduced pressure. The solid residue was taken up in water (10 ml) and the insoluble mass was filtered, washed with water (10 ml) and dried to give **15** as white crystals (0.8 g, 80%), mp 106° (ether/petroleum ether); ir (potassium bromide): 3500-3100 (OH); ^{1}H-nmr (DMSO-d_6) 7.41 (m, 4H-ϕ), 6.58 (m, H-3), 6.02 (m, H-1 and H-2), 5.32 (br, OH), 4.78 (m, H-8), 4.07 (dd, J H-5a H-5b = 12 Hz, J H-5a H-6 = 4 Hz, H-5a), 3.74 (t, J H-5b H-5a = 12 Hz, J H-5b H-6 = 12 Hz, H-5b), 3.21 (m, H-6), 2.15 (m, H-7a), 1.86 (q, J H-7b H-7a = 12 Hz, J H-7b H-6 = 12 Hz, J H-7b H-8 = 12 Hz, H-7b); ^{13}C-nmr (DMSO-d_6): 141.1 (C-1'), 133.2 (C-8a), 131.3 (C-4'), 129.1 (C-2' and C-6'), 128.4 (C-3' and C-5'), 118.1 (C-3), 107.6 (C-1), 104.2 (C-2), 64.1 (C-8), 50.6 (C-5), 38.2 (C-7 and C-6).

Anal. Calcd. for $C_{14}H_{14}NOCl$: C, 67.88; H, 5.70; N, 5.65. Found: C, 67.82; H, 5.68; N, 5.67.

cis 6-(4-Chlorophenyl)-5,6,7,8-tetrahydroindolizin-8-ylammonium Chloride **17**.

A solution of **12** (1.5 g, 0.0038 mole) in methanol (50 ml) was bubbled for 2 minutes at room temperature with an ammonia flow. The reaction mixture was stirred for 10 minutes and sodium borohydride (0.42 g, 0.011 mole) was then added. The stirring was maintained for 1 hour at room temperature and the solvent was then removed under reduced pressure. The solid

residue was taken up in water (50 ml) and the solution was extracted with ether (100 ml). The organic layer was dried over magnesium sulfate, filtered and bubbled with an hydrochloric acid gas flow. The precipitate was filtered, washed with dry ether and dried to give **17** as pink crystals (0.9 g, 80%) which were quickly used without other purification, mp >260°; ir (potassium bromide): 3100-2700 ($^+NH_3$); ^{1}H-nmr (DMSO-d_6): 8.81 (br, $^+NH_3$), 7.45 (d, J H-3' H-2' = 7.5 Hz, H-3' and H-5'), 7.42 (d, J H-2' H-3' = 7.5 Hz, H-2' and H-6'), 6.74 (m, H-3), 6.40 (m, H-1), 6.10 (m, H-2), 4.58 (m, H-8), 4.20 (dd, J H-5a H-5b = 12 Hz, J H-5a H-6 = 4 Hz, H-5a), 3.78 (t, J H-5b H-5a = 12 Hz, J H-5b H-6 = 12 Hz, H-5b), 3.33 (m, H-6), 2.40 (m, H-7a), 1.99 (q, J H-7b H-7a = 12 Hz, J H-7b H-6 = 12 Hz, J H-7b H-8 = 12 Hz, H-7b); ^{13}C-nmr (DMSO-d_6): 140.1 (C-1'), 131.7 (C-4'), 129.0 (C-2' and C-6'), 128.5 (C-3' and C-5'), 124.9 (C-8a), 120.0 (C-3), 108.0 (C-1), 105.8 (C-2), 50.2 (C-5), 45.0 (C-8), 37.8 (C-7), 33.0 (C-6).

cis 6-(4-Chlorophenyl)-5,6,7,8-tetrahydroindolizin-8-ylammonium Oxalate **18**.

A solution of **17** (0.56 g, 0.002 mole) in water (20 ml) was adjusted to *p*H = 8 with sodium hydrogen carbonate and then extracted twice with dichloromethane (2 x 75 ml). The organic layers were collected, dried over calcium chloride, filtered and the solvent was removed under reduced pressure. The oily residue was taken up in propan-2-ol and oxalic acid (0.36 g, 0.004 mole) was added to the solution which was refluxed for 30 minutes. After cooling, the precipitate was filtered, washed with ether (50 ml) and dried to give **18** as white crystals (0.44 g, 65%): mp >260° (ethanol); ir (potassium bromide): 3600- 3300 (OH), 3200-2700 ($^+NH_3$), 1640 (CO); ^{1}H-nmr (DMSO-d_6): 7.40 (m, 4H-ϕ), 6.72 (m, H-3), 6.50 (br, $^+NH_3$), 6.34 (m, H-1), 6.10 (m, H-2), 4.60 (m, H-8), 4.20 (dd, J H-5a H-5b = 12 Hz, J H-5a H-6 = 4 Hz, H-5a), 3.79 (t, J H-5b H-5a = 12 Hz, J H-5b H-6 = 12 Hz, H-5b), 3.35 (m, H-6), 2.40 (m, H-7a), 2.00 (q, J H-7b H-7a = 12 Hz, J H-7b H-6 = 12 Hz, J H-7b H-8 = 12 Hz, H-7b); ^{13}C-nmr (DMSO-d_6): 163.9 (CO_2H), 140.0 (C-1'), 131.8 (C-4'), 129.0 (C-2' and C-6'), 128.6 (C-3' and C-5'), 124.6 (C-8a), 120.3 (C-3), 108.2 (C-1), 105.7 (C-2), 50.2 (C-5), 45.0 (C-8), 37.9 (C-7), 32.9 (C-6).

Anal. Calcd for $C_{16}H_{17}N_2O_4Cl$: C, 57.06; H, 5.08; N, 8.31. Found: C, 57.10; H, 5.01; N. 8.23.

8-*N*-Benzylidenamino-6-(4-chlorophenyl)-5,6,7,8-tetrahydroindolizine **20**.

To a stirred solution of **12** (1.5 g, 0.0038 mole) in dimethylformamide (20 ml) was added benzylamine (0.6 ml, 0.0056 mole) and potassium carbonate (1 g, 0.0075 mole). The reaction mixture was refluxed for 2 hours, cooled and poured into water (100 ml). The solution was then extracted with ether (200 ml) and the organic layer was washed with water (2 x 100 ml), dried over magnesium sulfate and evaporated to dryness to give **20** (0.7 g, 56%) as white crystals which were used without other purification, mp 110°; ir (potassium bromide): 1670 (C=N); ^{1}H-nmr (DMSO-d_6): 7.30 (m, 9H-ϕ), 6.90 (m, H-3), 6.64 (m, H-1), 6.12 (m, H-2), 4.65 (d, J CHa CHb = 16.5 Hz, CHa), 4.59 (d, J CHb CHa = 16.5 Hz, CHb), 4.26 (dd, J H-5a H-5b = 12 Hz, J H-5a H-6 = 4 Hz, H-5a), 4.13 (t, J H-5b H-5a = 12 Hz, J H-5b H-6 = 12 Hz, H-5b), 3.51 (m, H-6), 3.07 (dd, J H-7a H-7b = 17 Hz, J H-7a H-6 = 4 Hz, H-7a), 2.78 (dd, J H-7b H-7a = 17 Hz, J H-7b H-6 = 12 Hz, H-7b).

cis 8-*N*-Benzylamino-6-(4-chlorophenyl)-5,6,7,8-tetrahydroindolizine **21**.

By use of the same method outlined for the synthesis of **16**, **21** (0.35 g, 57%) was obtained as an unstable oil from a reaction of **20** (0.6 g, 0.0018 mole) with sodium borohydride (0.14 g, 0.0036 mole); ir (potassium bromide): 3330 (NH); ^{1}H-nmr (DMSO-d_6): 7.30 (m, 9H-ϕ), 6.59 (m, H-3), 6.12 (m, H-1), 6.01 (m, H-2), 4.07 (dd, J H-5a H-5b = 12 Hz, J H-5a H-6 = 4 Hz, H-5a), 3.92 (dd, J H-8 H-7b = 12 Hz, J H-8 H-7a = 4 Hz, H-8), 3.89 (d, J CHa CHb = 14 Hz, CHa), 3.81 (d, J CHb CHa = 14 Hz, CHb), 3.78 (t, J H-5b H-5a = 12 Hz, J H-5b H-6 = 12 Hz, H-5b), 3.33 (br, NH), 3.18 (m, H-6), 2.28 (m, H-7a), 1.80 (q, J H-7b H-7a = 12 Hz, J H-7b H-6 = 12 Hz, J H-7b H-8 = 12 Hz, H-7b); ^{13}C-nmr (DMSO-d_6): 141.6 (C-1'), 141.4 (C-1"), 131.9 (C-4'), 131.2 (C-8a), 129.1 (C-2' and C-6'), 128.4 (C-3' and C-5'), 128.0 (C-3" and C-5"), 127.7 (C-2" and C-6"), 126.3 (C-4"), 118.5 (C-3), 107.5 (C-1), 103.9 (C-2), 52.1 (CH_2), 50.7 (C-5), 49.0 (C-8), 38.7 (C-7), 35.4 (C-6).

N-Benzyl-*N*-(*cis* 6-(4-chlorophenyl)-5,6,7,8-tetrahydroindolizin-8-yl)ammonium Chloride **22**.

A solution of **21** (0.35 g, 0.001 mole) in ether (50 ml) was bubbled for 15 seconds with a hydrogen chloride gas flow. The precipitate which appeared was filtered, washed with ether (50 ml) and dried to give **22** as white crystals (0.35 g, 94%), mp 156° (ethanol); ir (potassium bromide): 3100-2500 ($^+NH_2$); ^{1}H-nmr (DMSO-d_6): 10.25 (br, $^+NH_2$), 7.50 (m, 9H-ϕ), 6.80 (m, H-3), 6.60 (m, H-1), 6.14 (m, H-2), 4.76 (m, H-8), 4.20 (m, CH_2 and H-5a), 3.90 (t, J H-5b H-5a = 12 Hz, J H-5b H-6 = 12 Hz, H-5b), 3.25 (m, H-6), 2.56 (m, H-7a), 2.31 (q, J H-7b H-7a = 12 Hz, J H-7b H-6 = 12 Hz, J H-7b H-8 = 12 Hz, H-7b); ^{13}C-nmr (DMSO-d_6): 140.1 (C-1'), 132.2 (C-1"), 131.7 (C-4'), 130.1 (C-8a), 130.0 (C-2' and C-6'), 129.2 (C-3' and C-5'), 128.5 (C-2", C-3", C-5" and C-6"), 122.3 (C-4"), 120.7 (C-3), 108.0 (C-1), 107.4 (C-2), 51.0 (CH_2), 50.2 (C-5), 45.8 (C-8), 38.1 (C-7), 30.0 (C-6).

Anal. Calcd. for $C_{21}H_{22}N_2Cl_2$: C, 67.56; H, 5.93; N, 7.50. Found: C, 67.49; H, 6.20; N, 7.37.

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