acid solution[18] was allowed to stand for 24 hr. at room temperature. The mixture was then diluted with ice water, saturated with sodium chloride, and extracted with ethyl acetate. The extracts, after thorough washing with water and drying, yielded 240 mg. of a nearly colorless glass-like substance. Crystallization from acetone-hexane gave slightly discolored crystalline material which upon a second recrystallization from the same solvent mixture gave IVa, depending on the conditions (concentration), as colorless long thin needles or plates. The yield in two experiments was 54% and 65%, respectively; m.p. 154–156°, dec. (some change in appearance at 80–90°); further crystallization did not change the melting point, $[\alpha]_D$ +144.4° (*c* 0.31); λ_{max} 2.94 μ (OH); 4.62 μ (SCN); 5.66 μ (OAc); 5.75 μ (CO).

Anal. Calcd. for $C_{24}H_{33}O_6NS$: C, 62.18; H, 7.18; N, 3.02; S, 6.92. Found: C, 62.07; H, 7.19; N, 3.03; S, 6.96.

Ackdowledgment. The authors wish to express their great indebtedness for the supply of valuable starting materials to the Cancer Chemotherapy National Service Center, The Squibb Institute for Medical Research, and The Upjohn Company.

BETHESDA, MD.

[CONTRIBUTION FROM THE DEPARTMENT OF CHEMISTRY, STATE UNIVERSITY OF IOWA]

The Condensation of Phthalaldehydic Acids with Tryptophan and Tryptamine

S. WAWZONEK AND G. E. NELSON[1]

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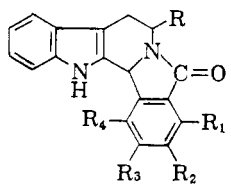
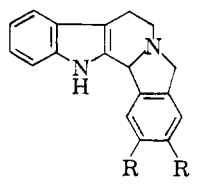
Tryptophan and tryptamine have been condensed with phthalaldehydic, opianic, *m*-opianic, and 3,4,5-trimethoxyphthalaldehydic acids. Tryptophan gives 1-(2-carboxyphenyl)-1,2,3,4-tetrahydro-9*H*-pyrido[3,4-*b*]indole-3-carboxylic acids which upon treatment with methanol and hydrogen chloride are cyclized to 5,7,8,13b-tetrahydro-5-oxo-13*H*-indolo[2,3-*c*]isoindolo[2,1-*a*]pyridines. Tryptamine in the same condensation gives these compounds directly. Cyclization occurs on the tetrahydropyridine nitrogen rather than the indole nitrogen, as alkylation of the sodium derivative with methyl iodide gives 13-methyl-5,7,8,13b-tetrahydro-5-oxo-indolo[2,3-*c*]isoindolo[2,1-*a*]pyridine. This product was also synthesized by the condensation of 1-methyl-3-(2-aminoethyl)indole with phthalaldehydic acid. Reduction of the lactam carbonyl group with lithium aluminum hydride was successful only for the condensation products from tryptamine and phthalaldehydic and opianic acids. The preparation of a similar derivative by the irradiation of 1-*o*-tolyl-2-bromo-1,2,3,4-tetrahydro-9*H*-pyrido[3,4-*b*]indole in carbon tetrachloride failed.

The synthesis of compounds containing the β-carboline nucleus has been of interest because this ring system occurs in a number of physiologically active compounds.

In the present work the syntheses of the pentacyclic compounds I and II, which resemble reserpine in certain respects, for testing as hypotensive agents are described.



I

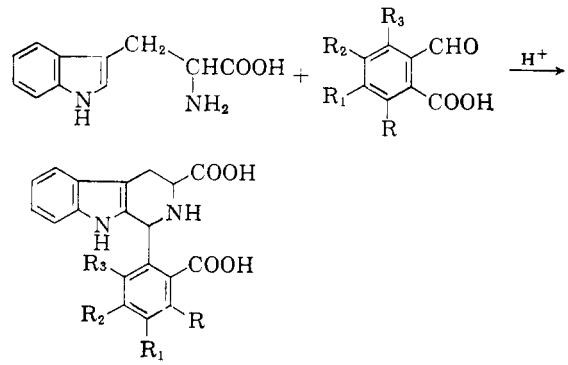


IIa. R = H
b. R = OCH_3

The preparation of 1-substituted β-carbolines was accomplished by means of the Pictet-Spengler reaction[2] using *dl*-tryptophan and tryptamine with various phthalaldehydic acids.

The reactions were carried out using approximately equimolar quantities of the aldehyde and amine in water with sufficient ethanol to give a homogeneous reaction mixture. The sulfuric acid concentration used in the condensation varied for the various examples and was in the range of 0.1 *N* to 0.33 *N*.

The condensation of tryptophan with phthalaldehydic acids gave the corresponding 1-(2-carboxyphenyl) - 1,2,3,4 - tetrahydro - 9*H* - pyrido-[3,4,-*b*]indole-3-carboxylic acids (III). These compounds were difficult to purify, retained solvents tenaciously and became highly colored when treated with polar solvents or acids. Pure samples (IIIa, IIId) were obtained only in the condensation with phthalaldehydic and 3,4,5-trimethoxyphthalaldehydic acids. The use of *dl*-tryptophan should



IIIa. R = R_1 = R_2 = R_3 = H
b. R = R_1 = OCH_3; R_2 = R_3 = H
c. R_1 = R_2 = OCH_3; R = R_3 = H
d. R_1 = R_2 = R_3 = OCH_3; R = H

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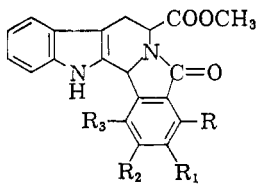
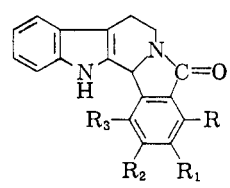
(1) Abstracted in part from the Ph.D. thesis, June 1959, of G. E. Nelson.

(2) W. M. Whaley and T. R. Govindachari, *Org. Reactions*, **6**, 151 (1951).

give two racemic modifications but only one was isolated.

Cyclization of these compounds (III) to the corresponding methyl 5,7,8,13b-tetrahydro-5-oxo-13*H*-indolo[2,3-*c*]isoindolo[2,1-*a*]pyridine-7-carboxylate (IV) was accomplished by treatment with hydrogen chloride in absolute methanol. The impure products





V

IVa. R = R_1 = R_2 = R_3 = H
b. R = R_1 = OCH_3; R_2 = R_3 = H
c. R_1 = R_2 = OCH_3; R = R_3 = H
d. R_1 = R_2 = R_3 = OCH_3; R = H

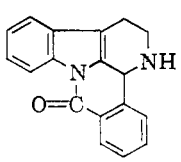
Va. R = R_1 = R_2 = R_3 = H
b. R = R_1 = OCH_3; R_2 = R_3 = H
c. R_1 = R_2 = OCH_3; R = R_3 = H
d. R_1 = R_2 = R_3 = OCH_3; R = H

(IIIb, IIIc) obtained from tryptophan and opianic and *m*-opianic acids were treated successfully in the same manner. The intermediate dimethyl esters were never isolated.

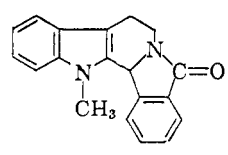
The condensation of tryptamine with phthalaldehydic acids gave the 5,7,8,13b-tetrahydro-5-oxo-13*H*-indolo[2,3-*c*]isoindolo[3,1-*a*]pyridines (V) directly in most examples. Products for which correct analyses were not obtained were treated further with methanol and sulfuric acid.

These lactams (IV, V) retained solvent of crystallization tenaciously. Repeated recrystallizations and protracted drying periods were necessary to obtain satisfactory analyses. Snyder[3] has reported similar difficulties in obtaining analytical samples with β-carbolines.

Cyclization in this series could also occur through the pyrrole nitrogen atom and would form 1,2,3,15-tetrahydro-10-oxo-9*H*-indolo[3,2,1-*d*,*e*]-1-azaphenanthridine (VI) from tryptamine and phthalaldehydic acid.



VI



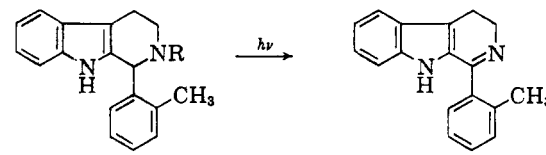
VII

Evidence for the structure of the lactam (Va) was its conversion to 13-methyl-5,7,8,13b-tetrahydro-5-oxo-indolo[2,3-*c*]isoindolo[2,1-*a*]pyridine (VII) by methylation of its sodium derivative with methyl iodide. The same compound (VII) was obtained by condensing 1-methyl-3-(2-aminoethyl)indole with phthalaldehydic acid and refluxing the resulting product with methanol and sulfuric acid.

(3) H. R. Snyder, C. H. Hansch, L. Katz, S. M. Parmerter, and E. C. Spaeth, *J. Am. Chem. Soc.*, **70**, 219 (1948).

Reduction of the lactam group in methyl 5,7,8,-13b-tetrahydro-5-oxo-13*H*-indolo[2,3-*c*]isoindolo-[2,1-*a*]pyridine-7-carboxylate (IVa) with excess lithium aluminum hydride failed. The product obtained had the correct analysis for the 7-methylol-5,7,8,13b-tetrahydro-5-oxo-13*H*-indolo[2,3-*c*]isoindolo[2,1-*a*]pyridine (I. R = CH_2OH, R_1 = R_2 = R_3 = R_4 = H). The infrared spectra were in agreement with this formulation. The band found for the ester group at 5.73 μ in IVa was absent in the reduction product.

The same reduction in the series (V) synthesized from tryptamine was successful with 5,7,8,13b-tetrahydro-5-oxo-13*H*-indolo[2,3-*c*]isoindolo-[2,1-*a*]pyridine (Va) and 2,3-dimethoxy-5,7,8,13b-tetrahydro-5-oxo-13*H*-indolo[2,3-*c*]isoindolo-[2,1-*a*]pyridine (Vc) but failed with other members of this series. Synthesis of one of these products, 5,7,8,13b-tetrahydro-13*H*-indolo[2,3-*c*]isoindolo[2,1-*a*]pyridine (IIa), by the ultraviolet light irradiation of 1-*o*-tolyl-2-bromo-1,2,3,4-tetrahydropyrido[5,6-*b*]indole (IXb) in sulfuric acid was not successful and resulted in the formation of insoluble



VIIIa. R = H
b. R = Br

IX

tars. This behavior is in agreement with the observations made[4,5] that the pyrindole nucleus is readily attacked by traces of oxidizing agents in strong acids. The use of carbon tetrachloride as a solvent for the irradiation of VIIIb resulted in the formation of a 1-*o*-tolyldihydro-9*H*-pyrido[5,6-*b*]-indole and 1-*o*-tolyl-1,2,3,4-tetrahydro-9*H*-pyrido-[5,6-*b*]indole (VIIIa). The actual location of the double band in the former was not established but is probably conjugated with the aromatic ring in the 1-position. A similar disproportionation has been found to occur in the irradiation of *N*-chlorodibutylamine in carbon tetrachloride.[6]

Pharmacological tests of these compounds showed mild hypotensive action only for 2,3-dimethoxy-5,7,8,13b-tetrahydro-13*H*-indolo[2,3-*c*]isoindolo[2,1-*a*]pyridine (IIb) hydrochloride.

EXPERIMENTAL[7]

1-(2-Carboxyphenyl)-1,2,3,4-tetrahydro-9H-pyrido[3,4-b]-indole-3-carboxylic acid (IIIa). A mixture of *dl*-tryptophan (5.0 g.) and phthalaldehydic acid (4.0 g.) in water (150 ml.) containing 30 ml. of 1*N* sulfuric acid was heated with

(4) B. Witkop, *J. Am. Chem. Soc.*, **75**, 3361 (1953).
(5) D. G. Harvey, E. J. Miller, and W. Robson, *J. Chem. Soc.*, 153 (1941).
(6) S. Wawzonek and J. D. Nordstrom, unpublished results.
(7) Melting points are not corrected.

TABLE I

TETRAHYDRO-5-OXO-13*H*-INDOLO[2,3-*c*]ISOINDOLO[2,1-*a*]PYRIDINES (I)

R	R_1	R_2	R_3	R_4	M.P.	Yield	Empirical Formula	Calcd. C	Calcd. H	Found C	Found H
$COOCH_3$[a]	OCH_3	OCH_3	H	H	154° dec.	30.5[b]	$C_{22}H_{20}O_5N_2$	67.35	5.10	67.59	5.02
$COOCH_3$[a]	H	OCH_3	OCH_3	H	158° dec.	45.0[b]	$C_{22}H_{20}O_5N_2$	67.35	5.10	66.85	4.98
$COOCH_3$[c]	H	OCH_3	OCH_3	OCH_3	226–227° dec.	95.8	$C_{23}H_{22}O_6N_2$	65.40	5.21	65.41	5.49
H[a]	OCH_3	OCH_3	H	H	183–186° dec.	42.6[d]	$C_{20}H_{18}O_3N_2$	71.85	5.39	71.15	4.95
H[a]	H	OCH_3	OCH_3	H	170–172° dec.	40.4[d]	$C_{20}H_{18}O_3N_2$	71.85	5.39	71.15	5.08
H[e]	H	OCH_3	OCH_3	OCH_3	215–218° dec.	24.9[d]	$C_{21}H_{20}O_4N_2$	69.23	5.49	69.05	5.46

[a] Recrystallized from ethanol and water. [b] Based on tryptophan. [c] Recrystallized from methanol and water. [d] Based on tryptamine. [e] Recrystallized from ethanol and benzene.

vigorous stirring on a steam bath for 24 hr. The volume of the reaction mixture was reduced to approximately 75 ml. and the mixture was cooled in an ice bath and filtered. The product was washed with cold water, dried, and recrystallized from an ethanol and water mixture. The yellow powder (5.4 g.) obtained melted at 198–200° dec.

Anal. Calcd. for $C_{19}H_{16}O_4N_2$: C, 67.85; H, 4.76; N, 8.33. Found: C, 67.45; H, 4.52; N, 8.28.

1-(2-Carboxy-4,5,6-trimethoxyphenyl)-1,2,3,4-tetrahydro-9H-pyrido[3,4-b]indole-3-carboxylic acid (IIId). A mixture of 3,4,5-trimethoxyphthalaldehydic acid (11 g.), *dl*-tryptophan (9 g.), 80 ml. of 1 *N* sulfuric acid, 40 ml. of ethanol, and 250 ml. of water was heated on a steam bath with vigorous stirring for 26 hr. The solution was cooled and the yellow product obtained was recrystallized from methanol and water. The yellow powder (14.8 g.) obtained melted at 195–196° dec.

Anal. Calcd. for $C_{22}H_{22}O_7N_2$: C, 61.97; H, 5.16. Found: C, 62.26; H, 5.08.

3,4,5-Trimethoxyphthalaldehydic acid. A solution of 4,5,6-trimethoxyphthalide[8] (5.0 g.) in 150 ml. of dry benzene was treated with 5.5 g. of *N*-bromosuccinimide in 200 ml. of dry carbon tetrachloride. The solution was refluxed for 4 hr. while being irradiated with a 60-watt lamp and was then kept at 5° overnight. The red solution was decanted from the crystalline residue and on evaporation gave a viscous orange-red oil. The oil was heated with 200 ml. of water for 1 hr. and the aqueous phase was decanted. The residue was treated with an excess of aniline and 25 ml. of methanol. Cooling the mixture gave the tan anil (m.p. 150° crude) which was filtered and heated 1 hr. with 50 ml. of 3 *N* hydrochloric acid. The solution after filtration was cooled and gave a yellow-green product. Crystallization from water gave 2.45 g. of fine tan needles, m.p. 129–130°.

Anal. Calcd. for $C_{11}H_{12}O_6$: C, 55.00; H, 5.00. Found: C, 54.63; H, 4.83.

Methyl 5,7,8,13b-tetrahydro-5-oxo-13H-indolo[2,3-c]isoindolo[2,1-a]pyridine-7-carboxylate (IVa). A solution of 1-(2-carboxyphenyl)-1,2,3,4-tetrahydro-9*H*-pyrido[3,4-*b*]indole-3-carboxylic acid (IIIa) (2 g.) in dry methanol (75 ml.) was saturated with dry hydrogen chloride and allowed to stand overnight. The red solution was again saturated with dry hydrogen chloride and refluxed for 2 hr., concentrated to 25 ml., and then poured into 200 g. of ice. The yellow-brown precipitate after recrystallization from dioxane and water gave white crystals (1.4 g.), m.p. 155°.

Anal. Calcd. for $C_{20}H_{16}O_4N_2$: C, 72.28; H, 4.85. Found: C, 71.96; H, 4.93.

The infrared spectra obtained in nujol had bands at 3.1 μ for the NH group, 5.72 μ for the ester carbonyl, and 5.98 μ for the lactam carbonyl.

This method was also used for the condensation product from 3,4,5-trimethoxyphthalaldehydic acid (IVd) and for the impure pyrindoles (IVb, IVc) from opianic acid[9] and *m*-opianic acid.[10]

Yields and other data are listed in Table I.

(8) F. E. King and T. J. King, *J. Chem. Soc.*, 726 (1942).

5,7,8,13b-Tetrahydro-5-oxo-13H-indolo[2,3-c]isoindolo[2,1-a]pyridine (Va). A solution of tryptamine (3.2 g.) and phthalaldehydic acid (3.0 g.) in a mixture of ethanol (100 ml.) and water (100 ml.) containing 20 ml. of 2 *N* sulfuric acid was heated with vigorous stirring for 40 hr. on a steam bath. A portion of the product separated from the hot reaction mixture. More product could be obtained by evaporating and cooling the filtrate. The combined products were recrystallized from ethanol and gave white prisms (1.9 g.) melting at 210–214°d.

Anal. Calcd. for $C_{18}H_{14}ON_2$: C, 78.83; H, 5.11. Found: C, 78.51; H, 5.04.

Similar conditions were used for the condensation of tryptamine with 3,4,5-trimethoxyphthaldehydic, opianic and *m*-opianic acids. The last two examples gave products for which satisfactory analyses were not obtained. These products were further refluxed in methanol (100 ml.) with concentrated sulfuric acid (5 ml.) for 4 hr. and poured onto ice. The yields and other data are listed in Table I.

13-Methyl-5,7,8,13b-tetrahydro-5-oxo-indolo[2,3-c]isoindolo[2,1-a]pyridine (VII). A solution of 5,7,8,13b-tetrahydro-5-oxo-13*H*-indolo[2,3-*c*]isoindolo[2,1-*a*]pyridine (Va) (2.9 g.) in dry tetrahydrofuran (100 ml.) was added dropwise to 0.5 g. of sodium hydride (49.6% suspension in mineral oil) in 50 ml. of dry tetrahydrofuran. After evolution of hydrogen had ceased, a solution of 1.4 g. of methyl iodide in 25 ml. of tetrahydrofuran was added and the mixture was refluxed 4 hr., cooled, and filtered. The solution upon evaporation to dryness gave a yellow-orange residue which after several recrystallizations from benzene and ligroin (b.p. 100–140°) gave 0.6 g. (20.8%) of yellow-tan crystals, m.p. 178–180°.

A solution of 1-methyl-3-(2-aminoethyl)indole and phthalaldehydic acid (3.0 g.) in 50 ml. of ethanol, 50 ml. of 2 *N* hydrochloric acid, and 100 ml. of water was heated with vigorous stirring for 18 hr. The ethanol was removed by evaporation and the solution was cooled and gave a semicrystalline mass. The product was filtered, dissolved in 100 ml. of absolute methanol containing 5 ml. of concentrated sulfuric acid, and refluxed for 12 hr. After concentration to half its volume, the solution was poured on to 200 g. of ice and gave 1.5 g. (25.9%) of a yellow powder; m.p. 169–175°. After several recrystallizations from benzene–ligroin (b.p. 100–140°), the product was obtained as a pale yellow powder, m.p. 185–186°.

The melting point of a mixture of the products prepared by the two methods melted at 183–186°.

Anal. Calcd. for $C_{19}H_{16}ON_2$: C, 79.17; H, 5.55. Found: C, 78.93; H, 5.75.

The infrared spectra of the two products in Nujol were identical and neither showed the band at 3.1 μ attributed to indole N—H.

(9) J. W. Wilson, III, C. L. Zirkle, E. L. Anderson, J. J. Stehle, and G. E. Ullyot, *J. Org. Chem.*, **16**, 792 (1951).

(10) J. J. Brown and G. T. Newbold, *J. Chem. Soc.*, 4397 (1952).

7-Methylol-5,7,8,13b-tetrahydro-5-oxo-13H-indolo[2,3-c]-isoindolo[2,1-a]pyridine (I. R = CH_2OH, $R_1 = R_2 = R_3 = R_4$ = H.) A solution of methyl 5,7,8,13b-tetrahydro-5-oxo-13*H*-indolo[2,3-*c*]isoindolo[2,1-*a*]pyridine-7-carboxylate (IVa) (1.5 g.) in 100 ml. of dry tetrahydrofuran was added slowly to 1 g. of lithium aluminum hydride in 100 ml. of ether. The mixture was refluxed 4 hours and the resulting complex decomposed with 3*N* hydrochloric acid. The organic layer was removed, evaporated to approximately 25 ml., and water was added until the solution became turbid. The solution upon cooling gave a greenish powder which was recrystallized from methanol and water. The yellow crystals (0.7 g.) melted at 225° with decomposition.

Anal. Calcd. for $C_{19}H_{16}O_2N_2$: C, 75.00; H, 5.26, N, 9.21. Found: C, 74.84; H, 4.89; N, 9.50.

The reduction was repeated using tetrahydrofuran and tetrahydrofuran and benzene as solvents, but the only product isolated was the above. The infrared spectra had a broad bend at 3.05 μ for the NH and OH groups and a band at 5.9 μ for the lactam carbonyl.

5,7,8,13b-Tetrahydro-13H-indolo[2,3-c]isoindolo[2,1-a]-pyridine (IIa). A solution of 5,7,8,13b-tetrahydro-5-oxo-13*H*-indolo[2,3-*c*]isoindolo[2,1-*a*]pyridine (Va) (1.16 g.) in 50 ml. of dry tetrahydrofuran was added dropwise to a slurry of 0.3 g. of lithium aluminum hydride in 50 ml. of tetrahydrofuran. After refluxing for 18 hr. the solution was concentrated to one-half its volume and diluted with an equal volume of dry benzene. The hydride was decomposed with water and the mixture was made acid to litmus by the addition of 10% hydrochloric acid. The resulting solution was heated and stirred vigorously for 30 min., the benzene layer was removed and concentrated to 50 ml. Addition of 100 ml. of methanol and cooling gave 0.4 g. of stickly brown needles. Recrystallization from ethanol gave 0.3 g. (29.9%) of a yellow-orange powder, m.p. 224–227° with decomposition.

Anal. Calcd. for $C_{18}H_{16}N_2$: C, 83.08; H, 6.15. Found: C, 82.47; H, 5.81.

2,3-Dimethoxy-5,7,8,13b-13H-indolo[2,3-c]isoindolo[2,1-a]pyridine (IIb) *hydrochloride.* A solution of 2,3-dimethoxy-5,7,8,13b-tetrahydro-5-oxo-13*H*-indolo[2,3-*c*]isoindolo[2,1-*a*]pyridine (Vc) (2.7 g.) in benzene was added dropwise to a slurry of 0.5 g. of lithium aluminum hydride in 50 ml. of tetrahydrofuran and the solution was stirred vigorously and refluxed for 12 hr. The mixture was cooled and the hydride was decomposed by the addition of water and 5% sodium bicarbonate solution. The solution was warmed, filtered, and evaporated to dryness. The product was dissolved in ether and the solution was saturated with dry hydrogen chloride. The hydrochloride was filtered and recrystallized from ethanol-benzene. The yellow powder (0.81 g.)melted at 232–234°.

Anal. Calcd. for $C_{20}H_{21}O_2N_2Cl$: C, 67.32; H, 5.86. Found: C, 68.05; H, 5.67.

1-o-Tolyl-1,2,3,4-tetrahydro-9H-pyrido[3,4-b]indole (VIIIa). A solution of tryptamine (2.65 g.) and *o*-tolualdehyde (2.3 g.) in ethanol (50 ml.) and water (150 ml.) containing 20 ml. of 2 *N* sulfuric acid was refluxed for 16 hr. The ethanol was removed by evaporation and the solution was cooled and extracted with two 50-ml. portions of ether. The dark red aqueous solution was treated with solid sodium carbonate until a slight excess was present. The precipitate formed was filtered and dried. Recrystallization from ethanol-water gave 1.75 g. of tan needles; m.p. 112–114° with decomposition.

Anal. Calcd. for $C_{18}H_{18}N_2$: C, 82.44; H, 6.87. Found: C, 81.81; H, 6.64.

The hydrochloride was prepared by treating the above product in ether with dry hydrogen chloride. The yellow green precipitate was recrystallized from isopropyl alcohol and melted at 184–186°.

Anal. Calcd. for $C_{18}H_{19}N_2Cl$: C, 72.36; H, 6.37. Found: C, 71.95; H, 6.05.

Irradiation of 1-o-tolyl-2-bromo-1,2,3,4-tetrahydro-9H-pyrido[3,4-b]indole (VIIIb). A solution of 1-*o*-tolyl-1,2,3,4-tetrahydro-9*H*-pyrido[3,4-*b*]indole (VIIIa) (1. g.) in 100 ml. of carbon tetrachloride was shaken vigorously with two 25 ml. portions of sodium hypobromite solution prepared by the addition of 50 g. of bromine to 500 ml. of 1.25 *N* sodium hydroxide solution. The carbon tetrachloride layer was washed with 20 ml. of 1% sodium hydroxide solution, 25 ml. of water, and dried over anhydrous potassium carbonate. Titration of an aliquot of the solution with sodium thiosulfate after addition to a potassium iodide solution showed a 70% conversion to 2-bromo-1-*o*-tolyl-1,2,3,4-tetrahydro-9*H*-pyrido[3,4-*b*]indole.

The dry solution was placed in a stoppered Vicor flask and irradiated with a Hanovia ultraviolet lamp for 24 hr. During the irradiation the solution was stirred slowly with a magnetic stirrer. A green product separated during the irradiation and was collected by filtration; yield, 0.7 g., m.p. 204–206°. The product was soluble in water and gave a yellow-white precipitate with silver nitrate solution. The aqueous solution was treated with ammonia and gave a flocculent, white precipitate which after several recrystallizations from ethanol-water gave 0.2 g. of tan-white needles, m.p. 153–154°. This product had the correct analysis for tolyl-3,4-dihydro-9*H*-pyrido[3,4-*b*]indole (IX).

Anal. Calcd. for $C_{18}H_{16}N_2$: C, 83.08; H, 6.15. Found: C, 83.17; H, 6.22.

Evaporation of the carbon tetrachloride reaction filtrate gave a brown residue which formed a hydrochloride (m.p. 184–186°) that was identical with 1-*o*-tolyl-1,2,3,4-tetrahydro-9*H*-pyrido[3,4-*b*]indole (VIIIa) hydrochloride.

Irradiation or heating a solutions of the 2-bromotetrahydropyridindole (VIIIb) in 85% sulfuric acid was unsuccessful; only insoluble tars were obtained.

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