The Synthesis, Configuration, and Conformation of *cis*- and *trans*-3-Amino-3,4-dihydro-1-hydroxy-4-methylcarbostyrils and Other Configurationally Related Compounds

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The *cis*- and *trans*-3-amino-3,4-dihydro-1-hydroxy-4-methylcarbostyrils (Ia and Ib) were synthesized by catalytic hydrogenation of *erythro*- and *threo*-α-amino-β-(*o*-nitrophenyl)butyric acid hydrochlorides, IIIa and IIIb, respectively, under acidic conditions. The free bases of IIIa and IIIb were catalytically hydrogenated under neutral conditions to yield the *erythro*- and *threo*-α-amino-β-(*o*-aminophenyl)butyric acids (VIa and VIb), which were converted by acidification to their corresponding lactams, *cis*- and *trans*-3-amino-3,4-dihydro-4-methylcarbostyrils, IIa and IIb. The *erythro* and *threo* isomers of α-amino-β-(*o*-nitrophenyl)-butyric acid were prepared and separated by liquid chromatography *via* a diastereomeric mixture of (V) of methyl α-acetamido-β-(*o*-nitrophenyl)butyrates. The configurations and conformational assignments of the cyclic hydroxamic acids Ia and Ib were first established by analysis of the proton nmr spectra. In turn, the configurations of the *o*-nitroaromatic amino acids IIIa and IIIb were assigned as well as the other structurally related compounds (VIa, VIb, IIa and IIb) derived therefrom.

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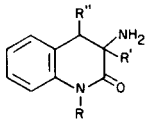
In a recent paper (1), the 3-methyl (R′ = CH_3, R″ = H) and 4-methyl (R′ = H, R″ = CH_3) substituted 3-amino-3,4-dihydro-1-hydroxycarbostyrils (R = OH) and 3-amino-3,4-dihydrocarbostyrils (R = H) were synthesized for microbiological studies. In particular, the nmr spectral

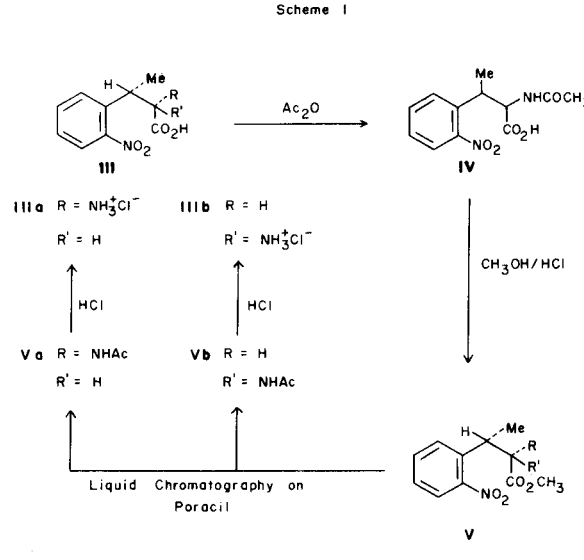


differences in the chemical shift characteristics indicated that each of the 4-methylated derivatives was a synthetic mixture consisting of nearly equal amounts of the two diastereomers (1). In view of this finding, it was of interest to extend this study to include the separation and the stereochemical assignments of the different diastereomeric compounds since so little information is available on the stereochemical aspects of diasymmetric heterocycles of this type. Therefore, the present paper contains the preparation of the *cis*- and *trans*-3-amino-3,4-dihydro-1-hydroxy-4-methylcarbostyrils (Ia and Ib) and the *cis*- and *trans*-3-amino-3,4-dihydro-4-methylcarbostyrils (IIa and IIb) and the elucidation of the configurational and conformational assignments based on proton nmr analysis.

Synthesis.

The synthesis and separation of the two diastereomers of α-amino-β-(*o*-nitrophenyl)butyric acid (IIIa and IIIb) were carried out first since they were the common intermediates from which all the other compounds in this study were derived. These two diastereomeric amino acids IIIa and IIIb were obtained as shown in Scheme I.

Scheme I



A diastereomeric mixture of III was treated with acetic anhydride in aqueous sodium hydroxide to afford α-acetamido-β-(*o*-nitrophenyl)butyric acid (IV) which, in turn, was esterified in methanol saturated with hydrogen chloride to give methyl α-acetamido-β-(*o*-nitrophenyl)-butyrate (V) composed of both diastereomers. At each stage of synthesis of IV and V, different fractions of the product were combined in order to recover as much of the two racemic diastereomers as the work-up procedure would yield. Subjection of the synthetic mixture of V so prepared to liquid chromatography on Poracil as described in the Experimental Section resulted in quantitative, base-line separation of the two diastereomeric racemates Va and Vb. In this separation, the faster-moving dia-

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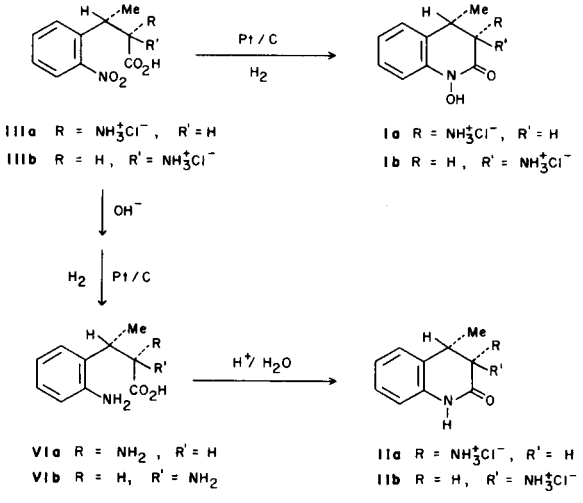
stereomer was established as the *erythro* form Va while the slower-moving diastereomer was the *threo* form Vb. The steric purity of each of the separated diastereomers V and Vb was analyzed by liquid chromatography on an analytical column under chromatographic conditions described in the Experimental. Both the *erythro* (Va) and *threo* (Vb) separated *N*-acetyl methyl esters were hydrolyzed in dilute hydrochloric acid to yield the corresponding *erythro-* and *threo*-α-amino-(*o*-nitrophenyl)butyric acid hydrochlorides (IIIa and IIIb), respectively.

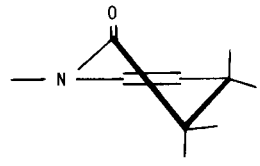
As presented in Scheme II, the *cis* (Ia) and *trans* (Ib) isomers of 3-amino-3,4-dihydro-1-hydroxy-4-methylcarbostyril were synthesized from the corresponding *erythro-* (IIIa) and *threo-* (IIIb) *o*-nitroaromatic amino acid hydrochlorides by catalytic hydrogenation under acidic conditions using platinum on charcoal as catalyst. When the corresponding free bases of IIIa and IIIb were catalytically hydrogenated under neutral conditions in the presence of the same catalyst, the *erythro-* (VIa) and *threo-* (VIb) isomers of α-amino-β-(*o*-aminophenyl)butyric acids were produced and subsequently cyclized in acidic solution to yield the *cis-* and *trans*-3-amino-3,4-dihydro-4-methylcarbostyrils, IIa and IIb, respectively.

Scheme II

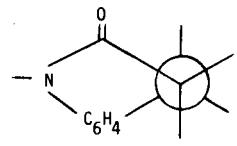


Stereochemistry.

Inspection of space-filled molecular models shows that the fused dihydro-α-pyridinone ring can assume two pseudo half-chair conformations in which the C-3 is bent out of the plane of the other atoms in the dihydrocarbostyril ring. Such conformations provide effective staggering of the bonds extending from the C-3 and C-4 atoms as represented by projectional formulas *A* and *B* with sighting along the C-3 and C-4 bond. Therefore, it follows that the diasymmetric 3,4-disubstituted-3,4-dihydrocarbostyrils exist in a *cis-trans* configurational relationship which resembles 1,2-disubstituted cyclohexanes.

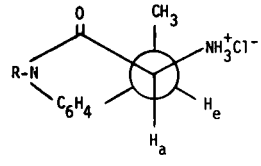


A

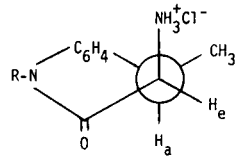


B

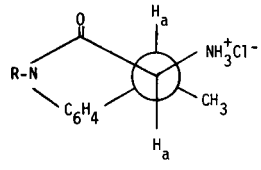
The *cis*-3-amino-4-methyl isomer of either the 3,4-dihydro-1-hydroxycarbostyril (R = OH) or the 3,4-dihydrocarbostyril (R = H) can exist in two possible conformations as shown by Newman projections *C* and *D*. Conformations *C* and *D* of the *cis* isomer hydrochloride salt have



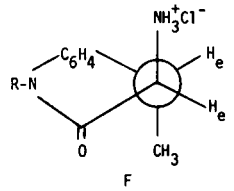
C



D



E



F

the C-3 NH_3^+ and the C-4 CH_3 groups in equatorial-axial and axial-equatorial positions, respectively. On the other hand, the two possible conformations of the *trans* hydrochloride salt of either the hydroxycarbostyril (R = OH) or the carbostyril (R = H) are given by projections *E* and *F*, which have the 3- and 4-substituents in diequatorial and diaxial positions, respectively. The assignment of configuration and the elucidation of the preferred conformation for each of the heterocyclic diastereomers were based on analysis of the proton nmr spectra as subsequently described.

Proton Nmr.

The proton nmr spectral properties of *cis-* and *trans*-3-amino-3,4-dihydro-1-hydroxy-4-methylcarbostyrils (Ia and Ib) and the *cis-* and *trans*-3-amino-3,4-dihydro-4-methylcarbostyrils (IIa and IIb) are presented in Table I. Since the configurational and conformational assignments could be established by nmr spectral analysis of either pair of heterocyclic diastereomers, the proton nmr results of the cyclic hydroxamic acids Ia and Ib are discussed in detail.

The magnitude of the coupling constants shown by adjacent protons attached to a ring system provides a means to differentiate between *cis* and *trans* configurations and to establish the preferred conformations (2). The nmr spectrum of each compound shows the absorption of the C-3

proton split into a doublet by the C-4 proton. On the basis of the coupling constants of 7 and 13 Hz of the C-3 doublets of the hydroxycarbostyrils Ia and Ib, respectively, the *cis* configuration was assigned to Ia and the *trans* configuration was assigned to Ib.

The coupling constant (J = 13 Hz) of the C-3 proton doublet of the *trans* isomer Ib also indicates that the C-3 and C-4 protons are diaxial to each other, which actually corresponds to conformation *E* (R = OH). The absorption of the axial C-4 proton appears as a multiplet because the signal is first split into a quartet by the C-4 CH_3 protons, each component of which is split into a doublet by the C-3 proton. Incidentally, the outer peaks of the "double quartet" were so weak that they were lost in the base noise for the amplitude used to record the spectrum. The multiplet (J = 7, 13 Hz) of the C-4 proton is centered at δ 3.40. The absorption of the protons of the equatorial CH_3 of Ib which appears at δ 1.55 is split into a doublet (J = 7.2 Hz) by the C-4 proton.

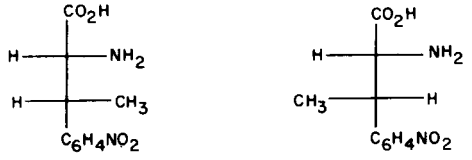
In contrast to the *trans* isomer, the C-4 proton multiplet of the *cis* isomer is observed as a distorted pair of closely overlapping quartets because of the slight difference in the two coupling constants (J = 5, 7 Hz). The midpoint of this multiplet is 3.65 δ which is at a lower field shift than the multiplet of the C-4 axial proton of the *trans* isomer. Since an equatorial proton is generally deshielded relative to an axial proton positioned on the same carbon atom (3), it was inferred that the C-4 proton of the *cis* isomer occupies the equatorial position which places the CH_3 group in the axial position as represented by conformation C (R = OH). In addition, the doublet of the C-4 CH_3 protons of Ia shows a higher upfield shift of δ 1.30 with a slightly different coupling constant (J = 7 Hz), than the doublet of the C-4 CH_3 protons of Ib which is indicative of a different orientation of the CH_3 group in conformation *C* from that of conformation *E*.

It has also been observed that an axial CH_3 group generally exerts a greater deshielding effect on an adjacent axial proton than that exerted by an equatorial CH_3 group (3). This observation similarly accounts for the lower field shift of the axial C-3 proton δ 4.7 of conformation *C* (axial C-4 CH_3) of the *cis* isomer (Ia) from that of δ 4.1 of conformation *E* (equatorial C-4 CH_3) of the *trans* isomer (Ib). Therefore, the preferred conformation of the *cis* isomer Ia, which is consistent with all of the nmr data, is *C* (R = OH).

On the basis of these proton results, it is concluded that the *cis*- and *trans*-3-amino-3,4-dihydro-1-hydroxy-4-methylcarbostyrils (Ia and Ib) exist preferentially in two rigid conformations, *C* and *E*, respectively, which differ only in their configuration about C-4. Based on these stereochemical assignments, the absolute configurations of the two diasymmetric heterocycles Ia and Ib can be designated as (3-*RS*,4-*SR*)*cis*- and (3-*RS*,4-*RS*)*trans*-3-amino-3,4-dihydro-1-hydroxy-4-methylcarbostyrils, respectively.

Configurationally Related Compounds.

Establishment of the configurations about the two asymmetric carbon atoms of the heterocyclic compounds now permits assignment of the same configurations to the corresponding diasymmetric amino acids, IIIa and IIIb, because reductive cyclizations of the latter compounds occur with no cleavage of bonds to asymmetric carbon atoms. The two preferred conformations, *C* and *E*, of the *cis* and *trans* compounds Ia and Ib can be transposed into the corresponding Fisher projections, IIIa and IIIb, of α-amino-β-(*o*-nitrophenyl)butyric acid of the same configurations. With reference to the Fisher projections, the



IIIa (3-RS,4-SR)erythro IIIb (3-RS,4-RS)threo

CH_3 groups of IIIa and IIIb are in the same relative positions as the OH groups of *erythro*- and *threo*-phenylserines, respectively (4). On this basis, the *erythro* and *threo* prefixes as generally used in the nomenclature of diasymmetric amino acids were likewise adopted to dif-

Table I

Proton Chemical Shifts of *cis*- and *trans*-3-Amino-3,4-dihydro-1-hydroxy-4-methylcarbostyrils and *cis*- and *trans*-3-Amino-3,4-dihydro-4-methylcarbostyrils (a)

Compound No.	C-3 H (b)	$J_{H,H}$	C-4 H (b)	J_{H,CH_3}	$J_{H,H}$	C-4 CH_3 (b)	$J_{CH_3,H}$	Ar-H
cis-Ia	4.7 (d)	5	3.65 (m)	7	5	1.30 (d)	7.0	7.2-7.65
trans-Ib	4.1 (d)	13	3.40 (m)	7	13	1.55 (d)	7.2	7.2-7.65
cis-IIa	4.75 (d)	5	3.70 (m)	7	5	1.45 (d)	7.0	7.1-7.9
trans-IIb	4.1 (d)	13	3.55 (m)	7	13	1.75 (d)	7.2	7.1-7.9

(a) Spectra obtained for the hydrochloride salts in deuterium oxide. Chemical shifts are given in δ values relative to sodium 2,2-dimethyl-2-silapentane-5-sulfonate (DDS). (b) d = doublet, m = multiplet.

ferentiate between the two diastereomers of the amino acids, IIIa and IIIb.

The stereochemical assignments of the *erythro* (VIa) and *threo* (VIb) α-amino-β-(*o*-aminophenyl)butyric acids and their corresponding lactams, the *cis* (IIa) and *trans* (IIb) 3-amino-3,4-dihydro-4-methylcarbostyrils are arrived at in a similar manner as previously described for the hydroxycarbostyrils and *o*-nitroaromatic amino acids.

Both the *cis*- and the *trans*-3-amino-3,4-dihydro-1-hydroxy-4-methylcarbostyrils were devoid of any observable inhibitory activity against the growth of *Escherichia coli* 9723 and *Lactobacillus plantarum* 8014 at concentrations of 200 μg/ml. These results suggest that the rigid conformations of the *cis* and *trans* compounds are not conducive to enzyme or receptor attachment which is requisite for growth-inhibiting activity.

In summary, this study concerning the synthesis, configuration, and conformation of the *cis*- and *trans*-3-amino-3,4-dihydro-1-hydroxy-4-methylcarbostyrils and configurationally related compounds has provided some additional stereochemical aspects of heterocyclic chemistry.

EXPERIMENTAL

General.

Melting points were determined on a Thomas-Hoover capillary melting apparatus and are uncorrected. Infrared spectra were recorded on a Beckman Model IR-10 spectrophotometer (potassium bromide) and were calibrated with polystyrene film. Nuclear magnetic resonance spectra were recorded in δ on a Perkin-Elmer R-12B spectrometer at 60 MHz using the internal standard sodium 2,2-dimethyl-2-silapentane-5-sulfonate (DSS) with deuterium oxide as the solvent.

The liquid chromatography system was constructed of commercial components: two high pressure pumps (Isco Model 314), Whitey switching valves (positioned up-stream from injection port), and Swagelok fittings; two detector units, either a differential refractometer (Waters Model 401) or an ultraviolet monitor (Isco Model UA-5); a recorder (Heathkit Model IR-18M). Samples were injected into the system using a Valvco Model CV-6-HPAX sample injection valve. The size of the chromatography columns, the commercial absorbants, and operating conditions are described as part of the separation procedure. Microanalyses were performed by M-H-W Laboratories, Phoenix, Arizona.

α-Amino-β-(*o*-nitrophenyl)butyric Acid Hydrochloride (III).

This compound was prepared as a mixture of approximately equal amounts of diastereomers as previously reported (1), mp 203-209°

α-Acetamido-β-(*o*-nitrophenyl)butyric Acid (IV).

Ten grams (0.038 mole) of the diastereomeric mixture of III dissolved in 100 ml of water was treated with a few drops of 50% aqueous sodium hydroxide to *p*H 10. While the reaction mixture was maintained at 0-5° with an ice bath, acetic anhydride (10.2 g, 0.1 mole) was added in increments of 0.5 to 1 ml. A few minutes were allowed between each addition for the acetic anhydride to react, and the *p*H was maintained at 10 by periodic additions of 50% aqueous sodium hydroxide. After the addition was completed, the reaction flask was placed in a refrigerator overnight. The reaction mixture was then treated with concentrated hydrochloric acid to *p*H 2, and the resulting oil was refrigerated overnight to give 8.0 g of product. Additional material was obtained by concentrating the filtrate in volume by removal of the solvent under reduced pressure, to give a total of 8.2 g (80%) of product, mp 147-151°.

Anal. Calcd. for $C_{12}H_{14}N_2O_5$: C, 54.13; H, 5.30; N, 10.52. Found: C, 53.89; H, 5.45; N, 10.36.

Methyl α-Acetamido-β-(*o*-nitrophenyl)butyrate (V).

Anhydrous hydrogen chloride was bubbled into one l. of absolute methanol maintained at 0° for one hour. At the end of this time, hydrogen chloride infusion was discontinued and 7.8 g (0.029 mole) of α-acetamido-β-(*o*-nitrophenyo)butyric acid was added. The reaction was allowed to come to room temperature over a 4 hour period with stirring. The reaction mixture was reduced *in vacuo* almost to dryness. The residue was dissolved in 200 ml methanol and the solution chilled at 0° overnight to yield a first crop of 3.0 g of product. There was recovered a total yield of 6.72 g (82%) of product, mp 136-140°, in four crops from repeated work-up of the mother liquor and crystallization from methanolic solution. A sample of the combined crops was submitted for analysis.

Anal. Calcd. for $C_{13}H_{16}N_2O_5$: C, 55.71; H, 5.76; N, 9.99. Found: C, 55.55; H, 5.58; N, 9.89.

Separation of the Diastereomers of Methyl α-Acetamido-β-(*o*-nitrophenyl)butyrates.

A solution of 2.0 g of the diastereomeric butyrates V in 30 ml of dichloromethane was injected into a liquid chromatographic system which included a 2.5 × 100 cm Poracil A column and a Waters Model 401 differential refratometer as the detector unit. The liquid chromatographic conditions were as follows: temperature, ambient; pressure, 80 lbs/in²; eluent, benzene, 48.5%/dichloromethane, 48.5%/iso-C_3H_7OH, 3.0%; flow rate, 5.42 ml/minute. For a single chromatographic run, the eluent was collected in three fractions which were based on the analytical purity of the diastereomer in each fraction as follows:

Fraction No.	Total Volume of Eluent (ml)	Time per Fraction (min)	Analysis of Fraction
1	260	50	100.0% Va
2	100	18	<0.2% Va and Vb
3	540	100	100.0% Vb

The purity of each fraction was determined by liquid chromatographic analysis. The liquid chromatographic system and conditions for the analysis were as follows: column, Partisil 10, 2.6 × 250 mm; detector, uv 1.2 AbFS (280 nm); temperature, ambient; pressure, 650 lbs/in²; eluent, benzene, 48.5%/dichloromethane, 48.5%/*iso*-C_3H_7OH, 3.0%; flow rate, 1.0 ml/minute. The recorded chromatograms of Fraction No. 1 and No. 3 showed that neither one of the separated diastereomers was contaminated by the presence of the other.

This procedure was repeated three times to effect separation of 6.0 g of the diastereomeric butyrate V in a period of about 10 hours.

Methyl *erythro*-α-Acetamido-β-(*o*-nitrophenyl)butyrate (Va).

The first eluted fractions from each of the three runs were combined and taken to dryness by removal of the solvents *in vacuo* to yield a quantative recovery of Va (3.0 g), mp 166-168°.

Anal. Calcd. for $C_{13}H_{16}N_2O_5$: C, 55.71; H, 5.76; N, 9.99. Found: C, 55.83; H, 5.57; N, 9.76.

Methyl *threo*-α-Acetamido-β-(*o*-nitrophenyl)butyrate (Vb).

The third fractions obtained from each of the three runs were combined and the solvents were evaporated *in vacuo* to yield 3.0 g (100% recovery) of Vb, mp 154-155°.

Anal. Calcd. for $C_{13}H_{16}N_2O_5$: C, 55.71; H, 5.76; N, 9.99. Found: C, 55.76; H, 5.72; N, 9.80.

erythro-α-Amino-β-(*o*-nitrophenyl)butyric Acid Hydrochloride (IIIa).

A solution of 2.25 g (0.008 mole) of the *erythro* isomer of V in 20 ml acetone and 150 ml of 4*N* hydrochloric acid was refluxed for about 3 hours. The reaction mixture was then treated with Darco G-60 and filtered. The filtrate was reduced in volume *in vacuo* to give an oily residue which produced crystals on treatment with acetone. There was

obtained a total of 1.53 g (73%), mp 205-211°, of crystalline solid in two fractions from the work-up of the mother liquor and washings.

Anal. Calcd. for $C_{10}H_{12}N_2O_4$·HCl: C, 46.07; H, 5.03; N, 10.75. Found: C, 45.90; H, 4.99; N, 10.69.

threo-α-Amino-β-(*o*-nitrophenyl)butyric Acid Hydrochloride IIIb).

In a manner similar to that above, a 2.25 g (0.008 mole) sample of the *threo* form of the methyl ester Vb was hydrolyzed to 720 mg (34%) of the product, mp 221-223°.

Anal. Calcd. for $C_{10}H_{12}N_2O_4$·HCl: C, 46.07; H, 5.03; N, 10.75. Found: C, 45.83; H, 5.02; N, 10.60.

erythro-α-Amino-β-(*o*-aminophenyl)butyric Acid (VIa).

A 500 mg (0.0022 mole) sample of the free base of *erythro* IIIa, mp 202-203°, prepared by treatment with sodium hydroxide was dissolved in 35 ml. of methanol-water (6:1) and hydrogenated at 3.67 kg/cm² of hydrogen pressure in the presence of 50 mg of 5% platinum on charcoal catalyst for 3 hours. The catalyst was removed by filtration and the filtrate reduced *in* vacuo to 3 ml. Storage at 0° for 12 hours yielded 300 mg (70%) of product, mp 188-189°. A small sample was recrystallized from hot ethanol for analysis.

Anal. Calcd. for $C_{10}H_{14}N_2O_2$: C, 61.82; H, 7.26; N, 14.42. Found: C, 61.87; H, 7.30; N, 14.43.

threo-α-Amino-β-(*o*-aminophenyl)butyric Acid (VIb).

In a similar manner to that described for VIa, 480 mg (0.0021 mole) of the *threo* form of IIIb was converted to 230 mg (55%) of product, mp 181-184°.

Anal. Calcd. for $C_{10}H_{14}N_2O_2$: C, 61.82; H, 7.26; N, 14.42. Found: C, 61.66; H, 6.97; N, 14.14.

cis-3-Amino-3,4-dihydro-1-hydroxy-4-methylcarbostyril Hydrochloride (Ia).

A solution of 1 g (0.0038 mole) of *erythro* IIIa in 6 ml of 50% methanol and 1 ml of concentrated hydrochloric acid was hydrogenated at 3.67 kg/cm² pressure in the presence of 100 mg of 5% platinum on charcoal catalyst for 3 hours. After removal of the catalyst by filtration, the solution was reduced in volume *in vacuo* to yield 620 mg (70%) of product, mp 255-258°. An analytical sample was obtained by recrystallization from water-acetone. The ir spectrum showed major absorption bands at 2960 (broad), 1670, 1590, 1490, 1465, 1440, 1410, 1340, 1020, 965 and 755 cm⁻¹.

Anal. Calcd. for $C_{10}H_{12}N_2O_2$·HCl: C, 52.52; H, 5.73; N, 12.25. Found: C, 52.66; H, 6.06; N, 12.10.

trans-3-Amino-3,4-dihydro-1-hydroxy-4-methylcarbostyril Hydrochloride (Ib).

A 0.5 g (0.0019 mole) sample of *threo*-diastereomer IIIb was reductively cyclized in the same manner as that described for Ia to yield 340 mg (77%) of product, mp 245-247°. The ir spectrum showed major absorption bands at 2900 (broad), 1670, 1600, 1490, 1460, 1400, 970 and 755 cm⁻¹.

Anal. Calcd. for $C_{10}H_{12}N_2O_2$·HCl: C, 52.52; H, 5.73; N, 12.25. Found: C, 52.31; H, 5.79; H, 12.32.

cis-3-Amino-3,4-dihydro-4-methylcarbostyril Hydrochloride (IIa).

One hundred milligrams (0.0005 mole) of VIa suspended in 5 ml methanol was acidified with 6 drops of concentrated hydrochloric acid to effect solution. The reaction mixture was reduced in volume to 1 ml *in vacuo* and the addition to 10 ml acetone caused precipitation of 87 mg (79%) of product, mp 251-254°. The ir spectrum showed major absorption bands at 3410, 2950 (broad), 1700, 1600, 1500, 1425, 780, 765 and 700 cm⁻¹.

Anal. Calcd. for $C_{10}H_{12}N_2O$·HCl: C, 56.47; H, 6.16; N, 13.17. Found: C, 56.13; H, 5.89; N, 12.93.

trans-3-Amino-3,4-dihydro-4-methylcarbostyril Hydrochloride (IIb).

A 200 mg (0.0010 mole) sample of VIb suspended in 5 ml methanol was treated with 5*N* hydrochloric acid to effect solution. Reducing the volume to 1 ml *in vacuo* and adding 10 ml of acetone caused the product to precipitate. There was recovered 120 mg (55%), mp 270-272°. The ir spectrum showed major absorption bands at 3410, 2950 (broad), 1695, 1590, 1490, 1455, 1410, 1365, 1340, 1110, 750 and 665 cm⁻¹.

Anal. Calcd. for $C_{10}H_{12}N_2O$·HCl: C, 56.47; H, 6.16; N, 13.17. Found: C, 56.62; H, 6.23; N, 13.03.

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