[Contribution from the National Institutes of Health]

REACTIONS WITH 4′-CARBOXY-4-CHLOROSTILBENE[1]

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In the foregoing communications (1, 2) we reported unsuccessful attempts to attach the alkamine chain —$CHOH(CH_2)_xNR_2$ to either of the bridge-carbon atoms of 4-chlorostilbene. It could be shown experimentally that this failure can be attributed to the interference of the bridge double bond with the various reactions necessary for the projected syntheses. We expected that, by placing the substituent requisite for building the alkamine chain in one of the benzene rings, no serious difficulties would be encountered. Eventually we succeeded in synthesizing the alkamines of type VII. Their similarity, however, to the biologically active 3-chlorophenanthrene-6-alkamines (3) is only superficial since the compounds of type VII belong to the *trans*-stilbene series.

One of the major practical difficulties was the conversion of III to IV. The methyl ester of IVb was shown to be identical with a compound which we prepared according to Fuson and Cooke (4) by condensing *p*-chlorobenzaldehyde and methyl α-bromo-*p*-toluate in the presence of zinc dust. We were unable to obtain the product in yields realized by these authors (22%), and therefore proceeded by way of I and III. In an attempted hydrolysis of III in alkaline medium, homoterephthalic acid was obtained.

The *trans* configuration for the cyanoester I (m.p. 126°) and the *cis* configuration for its irradiation product II (m.p. 116°) appear to be established through the U.V. absorption curves and their comparison with the *cis*- and *trans*-4-chloro-α-cyanostilbenes (see Fig. 1). Similarly the *trans*-methyl ester of IV (m.p. 166°) was converted to the *cis*-form (m.p. 63°) by irradiation. The latter can be reconverted (I_2) to the *trans*-form (see Fig. 2).

The preparation of a diazoketone from acid IVa, and its conversion to bromoketone VI proceeded without complication. In the reduction of VI with aluminum isopropoxide we were not able to isolate a sharp-melting, analytically pure bromohydrin. The dimethylamino alcohol (type VII) was prepared *via* the bromohydrin, while the corresponding diethylamino derivative was more advantageously prepared through the amino ketone. The benzylmethylamino and piperidino alcohols were obtained only by the latter route. The four amino alcohols were ineffective in blood-induced gallinaceum malaria and were considerably more toxic than quinine (5).

EXPERIMENTAL[3]

p-Toluic acid. The solid complex formed on addition of 116 g. (1.3 moles) of cuprous cyanide to 87 g. (1.1 moles) of pyridine began to melt at about 145°, and was efficiently

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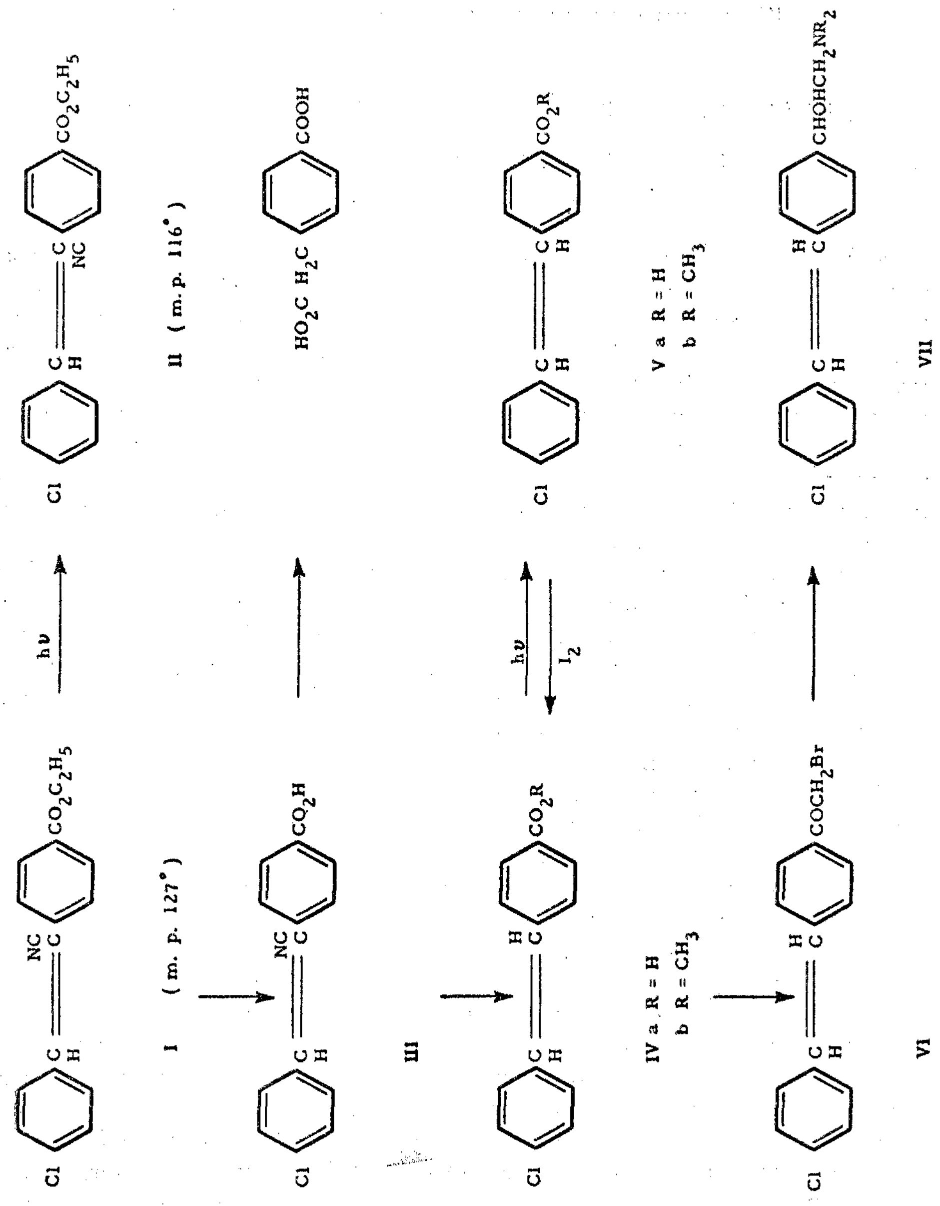
[3] All melting points given are corrected. The U.V. spectra were determined with a Beck-


Cl
H
C
NC
C
CO2C2H5
I (m. p. 127°)
hν
Cl
C
H
C
NC
CO2C2H5
II (m.p. 116°)
Cl
C
H
NC
C
CO2H
HO2C H2C
COOH
III
Cl
C
H
H
C
CO2R
IV a R = H
b R = CH3
hν
I2
Cl
C
H
C
H
CO2R
V a R = H
b R = CH3
Cl
C
H
H
C
COCH2Br
VI
Cl
C
H
H
C
CHOHCH2NR2
VII

stirred at 150–155° until all lumps had disappeared. After addition of 171 g. (1.0 mole) of *p*-bromotoluene, the temperature was raised, and maintained at 185–195° under reflux for 6 hours. The resulting dark-brown mass was mixed at room temperature with 500 ml. of 75% sulfuric acid and heated with constant stirring at 140–150° for two hours. The reaction mixture was poured into 800 ml. of ice and water and the precipitate was collected and treated with 1500 ml. of a 5% aqueous sodium hydroxide solution for 15 minutes. The filtrate was acidified with hydrochloric acid and the colorless precipitate was collected, washed well with water, and dried; yield, 120–130 g. (88–96%), m.p. 180–182°; lit. 179–180° (6).

α-Bromo-p-toluic acid. To a vigorously stirred solution of 50 g. (0.37 mole) of *p*-toluic acid in 75 ml. of nitrobenzene, heated to 170–190°, was added dropwise 64 g. of bromine (0.4 mole). Reaction took place immediately, and the addition required 45 minutes. The reaction mixture was cooled in ice and the dark-colored material was collected and triturated with nitrobenzene. After filtration, the precipitate was washed with ligroin and recrystallized from 95% ethanol, yielding 39 g. of nearly colorless needles of m.p. 222–225° (average yield, *ca.* 50%). A final recrystallization from ethanol raised the m.p. to 229–230°; lit. 223° (7).

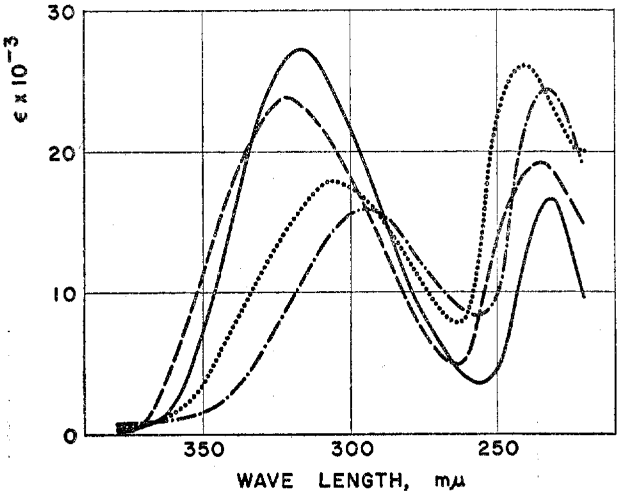


FIGURE 1. ULTRAVIOLET SPECTRA OF CYANOSTILBENES. — — —*trans*-4′-Carbethoxy-4-chloro-α′-cyanostilbene; ————*trans*-4-Chloro-α-cyanostilbene; ·········*cis*-4′-Carbethoxy-4-chloro-α′-cyanostilbene; —·—·—*cis*-4-Chloro-α-cyanostilbene

Methyl α-bromo-p-toluate. A solution of 90 g. of the above acid in a mixture of 25 ml. of conc'd sulfuric acid and one liter of methanol was refluxed for 75 minutes, concentrated under reduced pressure to *ca.* 200 ml., and diluted with 3 l. of water. The ester melted, after recrystallization from methanol, at 52–53°; colorless needles, yield 70–76%. A second recrystallization raised the m.p. to 54–55° (4).

Methyl α-cyano-p-toluate. A solution of 35 g. of sodium cyanide in 85 ml. of water was added during 10 minutes to a stirred solution of 70 g. of methyl α-bromo-*p*-toluate in 350 ml. of methanol. The mixture was kept at 50° for ½ hour, and diluted to one liter with cold water. The precipitate was filtered, dried, and recrystallized (Norit) from ligroin-benzene

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man Quartz Spectrophotometer, Model DU. All the compounds shown in the introduction (Figs. 1 and 2) were measured in absolute ethanol at the same concentration, *c*, 6.4×10^{-6} mole/l. The microanalyses are from the Institutes service analytical laboratory under the direction of Dr. William C. Alford.

(2:1) whereby 35 g. of colorless needles melting at 60–63° was obtained. The mother liquor yielded an additional 4 g. of m.p. 56–59°. The average yield was 70%. The analytical sample melted at 63–64°.

Anal. Calc'd for $C_{10}H_9NO_2$: N, 8.0. Found: N, 7.9.

trans-4'-Carbethoxy-4-chloro-α'-cyanostilbene (I). A solution of 32.3 g. of methyl α-cyano-*p*-toluate in 125 ml. of absolute ethanol and a solution of 26.1 g. of *p*-chlorobenzaldehyde in 125 ml. of absolute ethanol were combined and added during 40 minutes to a stirred sodium ethoxide solution (9.4 g. of sodium in 310 ml. of absolute ethanol) at 5–10°. A yellow precipitate formed immediately, and the reaction mixture was allowed to stand for ten minutes. The precipitate was collected, washed with small amounts of cold ethanol, and finally slurried in water. The product appeared lavender while wet, but yellow after drying. The average yield of the crude dried product (m.p. 125–126°) was 90%.[4] By recrystallization from methanol small yellow needles of m.p. 126–127° were obtained; λ_{max} 322, 236 mμ (log ε 4.38, 4.29).

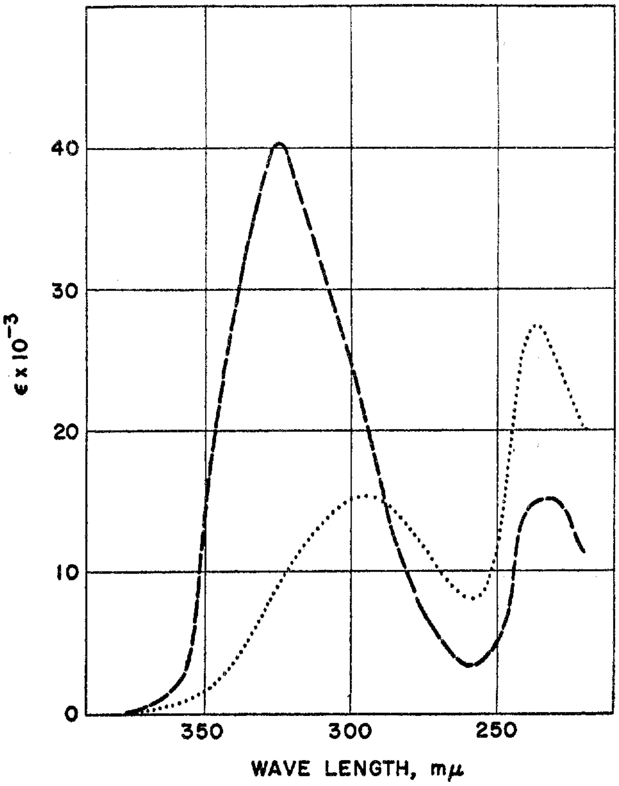

FIGURE 2. ULTRAVIOLET SPECTRA OF CHLOROSTILBENES. — — — *trans*-4'-Carbomethoxy-4-chlorostilbene; ········ *cis*-4'-Carbomethoxy-4-chlorostilbene

Anal. Calc'd for $C_{18}H_{14}ClNO_2$: C, 69.3; H, 4.5.

Found: C, 69.2; H, 4.4.

In this procedure, an exchange of the methyl group for ethyl had taken place. The above ester (I) was also prepared from acid III with ethanol, in the manner described below for the methyl ester.

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[4] If the time of addition exceeded 50 minutes, lower yields were obtained.

trans-4′-Carboxy-4-chloro-α′-cyanostilbene (III). A suspension of 51.6 g. of I in 820 ml. of acetic acid and 410 ml. of conc'd hydrochloric acid was kept boiling with stirring for three hours. After cooling, the pale-yellow product was filtered and washed with a small amount of acetic acid and finally with water. The crude dried product (m.p. 279–280° uncorr.) was obtained in yields of 92–95%. The acid crystallized from glacial acetic acid in clusters of pale-yellow needles, m.p. 282–283° (uncorr.).

Anal. Calc'd for $C_{16}H_{10}ClNO_2$: C, 67.7; H, 3.5.
Found: C, 68.0; H, 3.5.

trans-4′-Carbomethoxy-4-chloro-α′-cyanostilbene. A mixture of 1.0 g. of III, 0.5 ml. of conc'd sulfuric acid, and 30 ml. of methanol was refluxed for 5 hours. The crude ester was precipitated with water (1.1 g., m.p. 157–160°) and recrystallized from methanol; pale-yellow needles, m.p. 160–161°.

Anal. Calc'd for $C_{17}H_{12}ClNO_2$: C, 68.6; H, 4.1.
Found: C, 68.6; H, 4.2.

Conversion of III to homoterephthalic acid. A suspension of 5 g. of III in 200 ml. of 10% aqueous sodium hydroxide was kept boiling for eight hours. The resulting clear, colorless solution was acidified whereby material melting at 203–228° was obtained. This was dissolved in 150 ml. of ether and extracted with 20-ml. portions of 1% aqueous sodium hydroxide. The first three fractions gave, on acidification, colorless needles melting at 240–242° and weighing 1.9 g. By crystallization from glacial acetic acid 1.5 g. of an acid melting at 239–241° was obtained; lit. m.p. 237–238° (8). The mixture with an authentic sample of homoterephthalic acid of m.p. 239–241° melted at the same temperature.

Neutral equivalent: Calc'd for $C_9H_8O_4$: 90.1. Found: 89.4, 90.0.

Homoterephthalic acid. Methyl α-cyano-*p*-tolutae (0.5 g.) in 12 ml. of a 10% aqueous sodium hydroxide solution was refluxed for 30 minutes, the filtered solution was acidified, and the precipitate was washed and recrystallized from glacial acetic acid; yield nearly quantitative, m.p. 239–241°.

cis-4′-Carbethoxy-4-chloro-α′-cyanostilbene (II). A solution of 2.0 g. of I in 100 ml. of dry benzene was illuminated for 22 hours in the manner described previously (1). The pale yellow solution was evaporated to dryness (reduced pressure), leaving a yellow solid which was boiled for a few minutes with 10 ml. of ligroin (b.p. 65–67°). The ligroin-insoluble portion was recrystallized several times from ethanol and yielded colorless needles of m.p. 115–116°; average yield, 40%. The mixture with the *trans* compound I (of m.p. 126–127°) melted at 95–112°; λ_{max} 307, 240 mμ (log ε 4.26, 4.42).

Anal. Calc'd for $C_{18}H_{14}ClNO_2$: C, 69.3; H, 4.5.
Found: C, 69.3; H, 4.6.

trans-4′-Carboxy-4-chlorostilbene (IVa). A suspension of 5 g. of III in 20 ml. of glacial acetic acid and 20 ml. of conc'd hydrochloric acid was heated in a sealed tube at 170° for 24 hours. After cooling, a light-brown solid was collected and washed with water. The combined crude products thus obtained from 16 runs were slurried for two hours in 5% aqueous sodium hydroxide. The sparingly soluble sodium salt formed was filtered off and digested with 800 ml. of boiling glacial acetic acid. After cooling 51.0 g. (70%) of buff-colored material of m.p. 298–302° (uncorr.) was collected. Recrystallization from glacial acetic acid raised the m.p. to 302–304° (uncorr.) (A completely colorless sample was obtained by hydrolysis of the methyl ester with a mixture of glacial acetic acid and conc'd hydrochloric acid.)

Anal. Calc'd for $C_{15}H_{11}ClO_2$: C. 69.6; H. 4.3.
Found: C, 69.8; H, 4.7.

The alkaline filtrate of the sparingly soluble sodium salt gave on acidification *ca.* 7 g. of a product melting at 131–137°, which was not investigated further.

trans-4′-Carbomethoxy-4-chlorostilbene (IVb). A mixture of 14.6 g. of IVa and 150 ml. of thionyl chloride was boiled for 2.5 hours. Excess thionyl chloride was removed and the residue was washed well with petroleum ether. The crude acid chloride melted at 129–130° and weighed 14.8 g. It was used without further purification. When 0.5 g. of the compound was added to 10 ml. of methanol the ester which formed crystallized from methanol in colorless plates of m.p. 166–167°; λ_{max} 326, 232 mμ (log ε 4.61, 4.18).

Anal. Calc'd for $C_{16}H_{13}ClO_2$: C, 70.5; H, 4.8.
Found: C, 70.7; H, 4.9.

The melting point of a mixture with a sample prepared according to Fuson and Cooke (4) showed no depression.

cis-4'-Carbomethoxy-4-chlorostilbene (Vb). A solution of 2.0 g. of IVb in 175 ml. of benzene was illuminated for 26 hours. The benzene was removed under diminished pressure, leaving a semi-solid yellow mixture which was triturated with 75 ml. of ligroin and filtered. The filtrate was evaporated to dryness *in vacuo*, leaving 1.05 g. (52%) of a yellow solid which melted at 56–61°. Recrystallization from methanol gave 0.8 g. of colorless rods which melted at 62–63°; λ_{max} 296, 236 mμ (log ϵ 4.18, 4.44).

Anal. Calc'd for $C_{16}H_{13}ClO_2$: C, 70.5; H, 4.8.
Found: C, 70.6; H, 5.1.

cis-4'-Carboxy-4-chlorostilbene (Va). A small sample of Vb was dissolved in conc'd aqueous-ethanolic sodium hydroxide solution and heated at 90° for 10 minutes. The acid which precipitated upon diluting and acidifying was recrystallized from ethanol; colorless prisms, m.p. 167–169°.

Anal. Calc'd for $C_{15}H_{11}ClO_2$: C, 69.6; H, 4.3.
Found: C, 69.8; H, 4.4.

Conversion of Vb to IVb. A small sample of Vb and a crystal of iodine were dissolved in acetone. The solution was placed in a bath heated to 120–130° and the residue was heated at this temperature for 30 minutes after the acetone had boiled off. The reaction product was triturated with ligroin and finally recrystallized from ethyl acetate, m.p. 163–164°. The melting point with mixtures of IVb prepared above, showed no depression.

Decarboxylation of IVa. A mixture of 1.0 g. of IVa, 0.5 g. of cupric carbonate, and 6 ml. of quinoline was kept boiling for 30 minutes. The reaction mixture was treated with 200 ml. of 2 *N* hydrochloric acid and the dark residue was filtered, dried, and extracted with ether. The ethereal extract was washed with dilute alkali, evaporated, and the residue sublimed at 1 mm. whereby colorless material melting at 126–128° was obtained (yield *ca.* 15%). By recrystallization from ligroin (b.p. 65–67°) colorless leaflets of m.p. 128–129° were obtained which gave no depression of melting point with an authentic sample (1) of *trans*-4-chlorostilbene.

4-Chloro-4'-diazoacetylstilbene. The crude acid chloride (from 14.6 g. of IVa) was added in small portions during 10 minutes to 430 ml. of a stirred and cooled (5–10°) solution of diazomethane (from 26 g. of nitrosomethylurea) in methylene chloride. A gas was evolved, and from the resulting solution the diazo ketone began to separate after about 10 minutes. The mixture was allowed to stand for 12 hours, and the solvent was evaporated leaving a yellow crystalline residue. By recrystallization from benzene 14.1 g. (88%, calc'd from acid) of yellow prisms was obtained which melted at 144–147° with gas evolution. Several recrystallizations from benzene yielded pale-yellow prisms of m.p. 154–156° dec.

Anal. Calc'd for $C_{16}H_{11}ClN_2O$: C, 68.0; H, 3.9.
Found: C, 68.0; H, 4.1.

4'-Bromoacetyl-4-chlorostilbene (VI). To a solution of 13.2 g. of crude diazo ketone in 380 ml. of ethylene chloride kept at 40–45°, there was added with stirring a mixture of 30 ml. of ether and 30 ml. of 48% aqueous hydrobromic acid. After stirring for 40 minutes at this temperature, the mixture was evaporated to dryness under reduced pressure. By recrystallization from ethanol (Norit) 13.2 g. (84%) of a bromo ketone melting at 126–131° was obtained. The analytical sample, yellow needles, melted at 131–132°.

Anal. Calc'd for: $C_{16}H_{12}BrClO$: C, 57.2; H, 3.6.
Found: C, 57.1; H, 3.6.

4'-(2-Bromo-1-hydroxyethyl)-4-chlorostilbene. A mixture of 4.0 g. of the crude bromo ketone, 20 ml. of 1 *M* aluminum isopropoxide solution, and 80 ml. of 2-propanol was refluxed for two hours. The solvent was removed under reduced pressure and the residue was treated at room temperature with 6 *N* hydrochloric acid. The resulting yellow solid was collected and extracted with boiling ligroin (b.p. 65–67°). The pale-yellow crystalline product which separated from the cooled solution melted at 134–142° (average yield, 75%). Several crystallizations from ligroin did not change the melting point appreciably.

Anal. Calc'd for: $C_{16}H_{14}BrClO$: C, 56.9; H, 4.2.
Found: C, 57.5; H, 4.3.

4-Chloro-4'-(2-dimethylamino-1-hydroxyethyl)stilbene. A solution of 3.0 g. of the bromohydrin and 5.0 g. of dimethylamine in 50 ml. of benzene was heated in a sealed tube at 80° for 3 hours. The reaction mixture was evaporated to dryness and the yellow residue was triturated with petroleum ether. Recrystallization of the solid residue from ethanol gave pale-yellow needles melting at 160–163°. The average yield was 65%. Several recrystallizations raised the m.p. to 164–165°.

Anal. Calc'd for: $C_{18}H_{20}ClNO$: C, 71.6; H, 6.7.
Found: C, 71.7; H, 6.8.

The *hydrochloride* precipitated as colorless needles by adding ethereal hydrogen chloride to the ethereal solution of the base. It may be recrystallized from 2-propanol; m.p. 229–230°, dec.

Anal. Calc'd for $C_{18}H_{20}ClNO \cdot HCl \cdot H_2O$: C, 60.7; H, 6.5.
Found: C, 61.1; H, 6.4.

4-Chloro-4'-(2-diethylamino-1-oxoethyl)stilbene. A mixture of 6.0 g. of bromo ketone VI and 4.0 g. of diethylamine in 300 ml. of dry ether was boiled for 1.5 hours, and allowed to stand at room temperature for 18 hours. Diethylamine hydrobromide (87% of the expected amount) was collected, the ethereal filtrate was washed with water and dried, and the amino ketone hydrochloride was precipitated as a yellow solid weighing 5.0 g. (73%). After recrystallization from butanone it melted at 201–207° dec.

Anal. Calc'd for: $C_{20}H_{22}ClNO \cdot HCl \cdot H_2O$: C, 62.8; H, 6.6.
Found: C, 62.8; H, 6.6.

4-Chloro-4'-(2-diethylamino-1-hydroxyethyl)stilbene. To a solution of 1.7 g. of the above amino ketone hydrochloride in 100 ml. of 2-propanol was added 16 ml. of 1 *M* aluminum isopropoxide solution. The mixture was refluxed for 7 hours. After evaporation of the solvent *in vacuo*, the residue was partitioned between 10% aqueous sodium hydroxide and ether. The ether layer was washed with water, dried, and evaporated, leaving a yellowish solid which after recrystallization from 2-propanol melted at 126–128°. Yield, 0.7 g. (48%).[5] Several recrystallizations from 2-propanol gave colorless prisms of m.p. 128–129°.

Anal. Calc'd for: $C_{20}H_{24}ClNO$: C, 72.8; H, 7.3.
Found: C, 72.6; H, 7.1.

The *hydrochloride* crystallized from 2-propanol in colorless needles of m.p. 206–207° (dec.).

Anal. Calc'd for: $C_{20}H_{24}ClNO \cdot HCl$: C, 65.6; H, 6.9.
Found: C, 65.7; H, 6.8.

4-Chloro-4'-(2-benzylmethylamino-1-oxoethyl)stilbene. To 6.0 g. of bromo ketone VI in 600 ml. of benzene was added 9.0 g. of benzylmethylamine. Almost immediately the hydrobromide of the latter began to precipitate. The salt was collected after two hours and the filtrate was evaporated *in vacuo* to dryness. The remaining red oil was taken up in ether and hydrogen chloride was passed into the solution. The yellowish precipitate, weighing 10.5 g., was triturated with butanone whereby most of the color was removed. Treatment with dilute hydrochloric acid removed benzylmethylamine and left 5.7 g. (74%) of amino ketone hydrochloride of m.p. 150–154°. Repeated recrystallization from butanone did not alter the melting point.

Anal. Calc'd for: $C_{24}H_{22}ClNO \cdot HCl \cdot H_2O$: C, 67.0; H, 5.8; N, 3.2.
Found: C, 67.7; H, 5.8; N, 3.7.

4-Chloro-4'-(2-benzylmethylamino-1-hydroxyethyl)stilbene. To a solution of 1.0 g. of the amino ketone hydrochloride in 35 ml. of 2-propanol was added 10 ml. of 1 *M* aluminum isopropoxide solution. The mixture was refluxed for 3 hours, 2-propanol was removed under reduced pressure, and the yellow residue was triturated with 40 ml. of 4 *N* HCl and filtered off. The crude product dissolved readily in butanone (7 ml.) from which it began to separate immediately in clusters of needles, m.p. 223–225°. Yield, 0.6 g. (62%). Recrystallization from 2-propanol gave pale-yellow needles of m.p. 225–226°.

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[5] This amino alcohol could also be obtained from the bromohydrin and diethylamine but the yields were lower.

Anal. Calc'd for: $C_{24}H_{24}ClNO \cdot HCl$: C, 69.6; H, 6.1.
Found: C, 69.6; H, 6.3.

The *base* was obtained as a white solid by suspending the salt in dilute sodium hydroxide solution. It gave on recrystallization from absolute ethanol colorless clusters of irregularly shaped plates melting at 151–152°.

Anal. Calc'd for: $C_{24}H_{24}ClNO$: C, 76.3; H, 6.4; N, 3.7.
Found: C, 75.8; H, 6.4; N, 3.8.

4-Chloro-4'-(2-piperidino-1-oxoethyl)stilbene. To 6.7 g. of bromo ketone VI in 250 ml. of dry benzene 5.1 g. of piperidine was added. Piperidine hydrobromide precipitated immediately. After 2 hours it was filtered off, the filtrate was evaporated *in vacuo* to dryness, and the remaining yellow residue was washed with water, and finally triturated with ethanol. The crude yellowish reaction product weighed 5.6 g. and melted at 129–132°. The average yield was between 80–85%. Repeated recrystallization from ethanol gave pale-yellow needles of m.p. 132–135°.

Anal. Calc'd for: $C_{21}H_{22}ClNO$: C, 74.2; H, 6.5.
Found: C, 74.4; H, 6.5.

The *hydrochloride* was prepared by passing hydrogen chloride over the ethereal solution of the base. By recrystallization from absolute ethanol light-yellow prisms were obtained which melted at 244–247°, evac. tube, dec.

Anal. Calc'd for: $C_{21}H_{22}ClNO \cdot HCl$: C, 67.0; H. 6.2.
Found: C, 66.5; H, 6.6.

4-Chloro-4'-(2-piperidino-1-hydroxyethyl)stilbene. To a solution of 3 g. of the above base in 66 ml. of 2-propanol was added 13 ml. of 1 *M* aluminum isopropoxide solution. The mixture was kept boiling for 3 hours, 2-propanol was removed under reduced pressure, and the residue was partitioned between 20% aqueous sodium hydroxide and benzene. The benzene solution was washed with water and dried, and on evaporation left a yellow solid. By recrystallization from 2-propanol the amino alcohol was obtained as clusters of yellowish leaflets melting at 171–175°, average yield, 50%. Repeated recrystallization from 2-propanol yielded nearly colorless leaflets of m.p. 177–178°.[6]

Anal. Calc'd for: $C_{21}H_{24}ClNO$: C, 73.8; H, 7.1.
Found: C, 74.0; H, 7.2.

The *hydrochloride* was obtained by suspending the base in dilute hydrochloric acid. Recrystallization from 2-propanol gave pale-yellow needles which melted in an evacuated tube at 264–265°, uncorr.

Anal. Calc'd for: $C_{21}H_{24}ClNO \cdot HCl$: C, 66.7; H, 6.7; N, 3.7.
Found: C, 66.6; H, 6.7; N, 3.7.

SUMMARY

The synthesis of 4-chlorostilbene-4'-alkamines (VII) *via* 4-chloro-4'-carbethoxy-α-cyanostilbene (I) is described. The steric configurations of I and 4-chloro-4'-carbomethoxystilbene (IVb) have been established through their U.V. spectra.

BETHESDA 14, MD.

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[6] When the amino ketone hydrochloride was subjected to reduction, twice the amount of solvent was required. The result was approximately the same.