ANNELATION OF QUINOXALINE BY SULFUR STABILIZED CARBANIONS.

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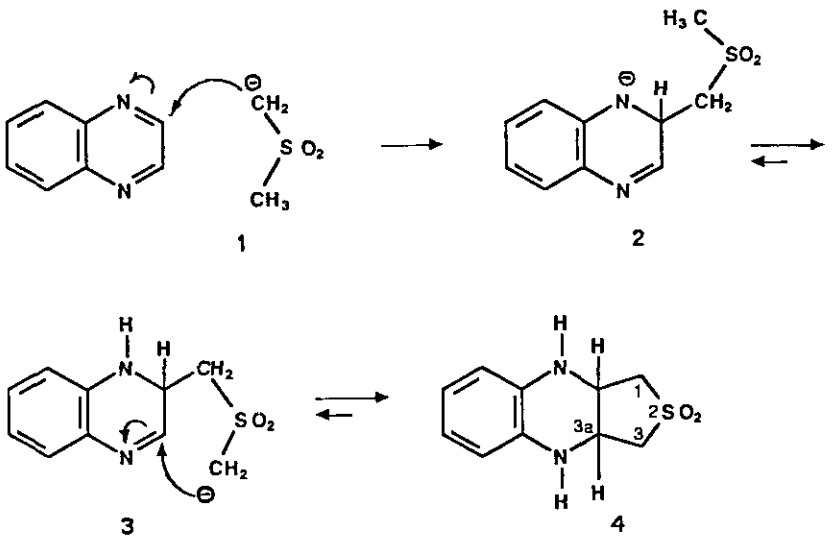
Abstract - Thieno[3,4-b]quinoxaline derivatives were prepared by nucleophilic addition of carbanions of sulfones, sulfoxides and sulfides on quinoxaline. The use of dissymmetric sulfones or sulfoxides gave diastereoisomers which were isolated and characterized.

Organometallic compounds are of little value in the metalation of alkylquinoxalines. Their tendency is rather to add to the azomethine linkage of quinoxaline, and this addition is often followed by hydride elimination restoring the aromaticity of the nucleus [1]. Such reactions may afford a way of synthesis for substituted quinoxalines. Similar procedures involving intramolecular nucleophilic attack by a deprotonated amino group have been used for the annelation of quinoxaline, by creation of a pyrrole [2] or aziridine [3] heterocycle. We report here a twofold addition of carbanions from sulfones, sulfoxides and sulfides to the azomethine linkage of quinoxaline and the isolation of diastereoisomers with a relative stereoselectivity in the case of dissymmetric sulfones and sulfoxides.

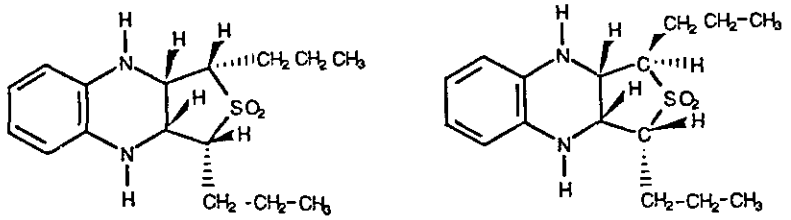
Sulfones were studied first. Dimethyl sulfone (1 mol) was metalated by butyllithium or lithium diethylamide (LDA) (1 mol) and carbanion 1 then reacted with quinoxaline by nucleophilic addition according to Scheme 1. The yield of adduct 4 was 82 %.



Scheme 1

In a complementary experiment, the dianion of dimethyl sulfone, initially prepared by use of a twofold excess of butyllithium, was condensed with quinoxaline. The yield of compound 4 was not increased (75 %), and, consequently, our standard procedure for metalation was performed with 1/1 quantities of sulfone and butyllithium or LDA. This involves, in adduct 2, an internal metalation of the methyl group to give carbanion 3 which cyclizes by a second nucleophilic attack (Scheme 1).

The structure of 4 was established by elemental analysis, and by mass, ^{1}H and ^{13}C nmr spectrometry. The condensation of dibutyl sulfone with quinoxaline formed two chiral centers, and we could isolate two diastereoisomers, 5 (46 %) and 6 (33 %), by column chromatography.



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Their structure was elucidated by ^{1}H and ^{13}C nmr (Table I). For compound 5, symmetry can be observed in ^{1}H and ^{13}C nmr spectra. Coupling constants J_{1-9a} = 5 Hz and J_{3a-3} = 5 Hz are in agreement with a cis configuration for H_3-H_{3a} and H_1-H_{9a}.

TABLE I

^{1}Hnmr	H_1	H_3	H_{3a}	H_{9a}	H_5	H_8	H_6	H_7
4	3.60-2.90 (4H)		4.30-4.00 (2H)		6.60-6.40 (4H)			
5	3.15 (2H)		3.65 (2H)		6.70-6.50 (4H)			
6	3.15 (1H)	3.20 (1H)	3.95 (1H)	3.60 (1H)	6.75-6.55 (4H)			
7	3.25 (1H)	3.15 (1H)	3.68 (1H)	3.62 (1H)	6.75-6.55 (4H)			
8	3.20 (1H)	3.20 (1H)	3.95 (1H)	3.55 (1H)	6.75-6.55 (4H)			
9	3.35 (1H)	3.15 (1H)	3.65 (1H)	3.90 (1H)	6.80-6.50 (4H)			
10		3.10 (1H)	3.75 (1H)	3.85 (1H)	6.80-6.50 (4H)			

	J_{1-9a}	J_{3a-9a}	J_{3-3a}
5	5 Hz		5 Hz
6	11 Hz	3 Hz	5 Hz
7	6 Hz	4 Hz	3 Hz
8	11 Hz	3 Hz	4 Hz
9	4.5 Hz	3 Hz	11 Hz
10		4 Hz	12 Hz

^{13}Cnmr	C_1	C_3	C_{3a}	C_{9a}	C_{4a}	C_{8a}	C_5	C_8	C_6	C_7
4	56.3		49.8		130.7		113.9		118.0	
5	54.4		65.3		130.0		115.0		119.9	
6	50.4	55.4	61.9	66.0	129.1	130.4	115.1	115.6	119.6	120.0
7	54.2	55.5	60.2	65.4	129.9		114.8		119.6	
8	50.4	56.5	56.8	65.9	130.3	129.2	115.1	115.5	119.6	120.1
9	51.2	55.4	61.1	61.5	130.4	130.7	114.9	115.5	119.6	120.1
10	71.8	61.4	53.1	61.9	128.0-131.0		111.6-120.3			

The ^{1}H and ^{13}C nmr spectra of isomer 6 involve molecular dissymmetry (Table I) since chemical shifts for protons and carbons in 1-3 and 3a-9a positions are different. The junction of pyrazine and thiophene rings is cis (J_{3a-9a} = 3 Hz). Protons in 3 and 3a are also cis (J_{3-3a} = 5 Hz), while protons in 1 and 9a are trans (J_{1-9a} = 11 Hz).

In the preponderant diastereoisomer 5 the propyl substituents are in a pseudoequatorial position. A more complex case was studied when we reacted a dissymmetrical sulfone, ethylbutyl sulfone, with quinoxaline. Four products could be isolated by column chromatography : three isomers 7, 8, 9 and a more complex compound 10. In all of these compounds, the pyrazine-thiophene junction is cis (J_{3a-9a} = 3-4 Hz). The structure proposed for 7 is supported by the low values of coupling constants (J_{1-9a} = 6 Hz and J_{3-3a} = 3 Hz). In compound 8, the configuration is cis for protons H_3 and H_{3a} (J_{3-3a} = 4 Hz) and trans for protons 1 and 9a (J_{1-9a} = 11 Hz), while in compound 9, protons H_3 and H_{3a} are trans (J_{3-3a} = 11 Hz) and H_1 and H_9 are cis (J_{1-9a} = 4.5 Hz).

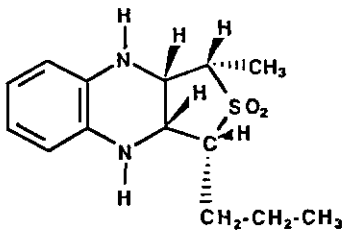
While 7, 8 and 9 are diastereoisomeric molecules, the structure of 10 is quite different. Elemental analysis and mass spectrometry ($M^{+\cdot}$ = 410) were in agreement with the condensation of 1 mol of compounds 7, 8, 9 or a fourth isomer with 1 mol of quinoxaline. In the ^{13}C nmr spectrum, characteristic signals of a singlet for C_1 and a doublet for C_3 suggested that C_1 was a junction center.

Decisive arguments were obtained by ^{1}H nmr spectroscopy :

- H_{3a} and H_{9a} are cis (J_{3a-9a} = 4 Hz) ;
- H_{3a} and H_3 are trans (J_{3a-3} = 12 Hz) ;
- $J_{2'-3'}$ = 5 Hz supports a cis junction ;

The irradiation of the methyl group on C_1 gave an NOE effect on H_{9a} but not on $H_{3'}$; H_{9a} and CH_3 are cis while $H_{3'}$ and CH_3 are trans.

A 2 D-nmr correlated ^{1}H-^{13}C nmr spectrum allowed a complete assignment and the establishment of its stereochemistry [4]. Compound 10 was probably formed by the condensation of the fourth diastereoisomer with a second mol of quinoxaline.



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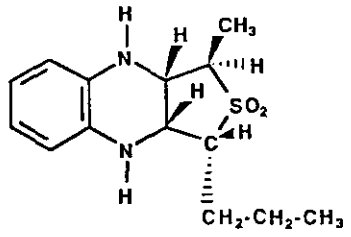

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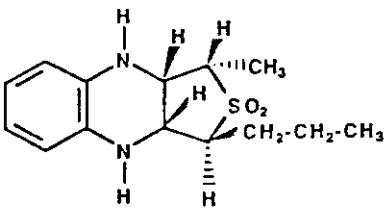

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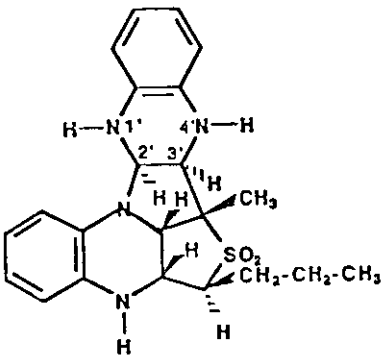

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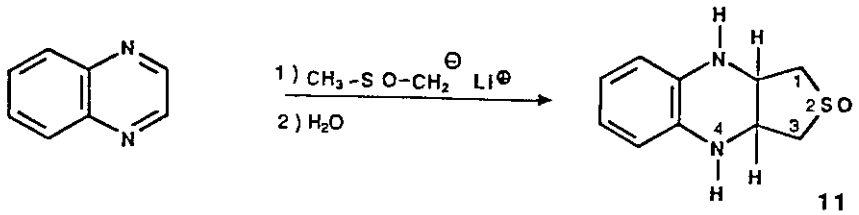
Sulfoxides reacted in the same way as sulfones, but yields were lower (51 % in the case of 11).



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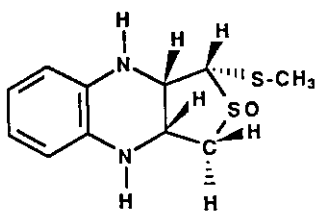
The condensation of the dissymmetrical sulfoxide CH_3-SO-CH_2-S-CH_3 with quinoxaline led to compounds 12 and 13.



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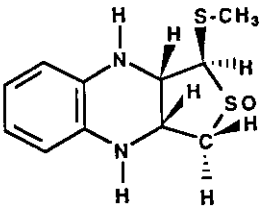

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In the ^1H nmr spectrum of 13, coupling constants were in agreement with a cis junction (J_{3a-9a} = 4 Hz) and a trans configuration for H_{9a} and H_1 (J_{1-9a} = 9 Hz).
In the case of 12, it was not possible to differentiate between H_1, H_{3a} and H_{9a}, because of the proximity of their chemical shifts (see Table II). If we except the stereochemistry of sulfoxide, the formation of only two diastereoisomers is predictable and we can assign to 12 the configuration where S-CH_3 is α and H_1, H_{3a}, H_{9a} are β.

TABLE II

^{13}Cnmr DMSOd$_6$	C_1	C_3	C_{3a}	C_{9a}	C_{4a}	C_{8a}	C_5	C_8	C_6	C_7
12	75.3	55.2	52.2	56.9	130.7	131.6	113.8	117.5	118.0	114.0
13	68.1	58.5	50.4	58.5	131.5	131.9	113.6	118.6	118.8	114.1

^{1}Hnmr DMSOd$_6$	H_1	H_3	H_{3a}	H_{9a}	H_5	H_8	H_6	H_7
12	3.8-3.7 (1H)	3.62 (1H) 2.65 (1H)	3.8-3.7 (2H)		6.60-6.40 (4H)			
13	3.85 (1H)	3.60 (1H) 2.80 (1H)	3.90 (1H)	4.12 (1H)	6.55-6.35 (4H)			

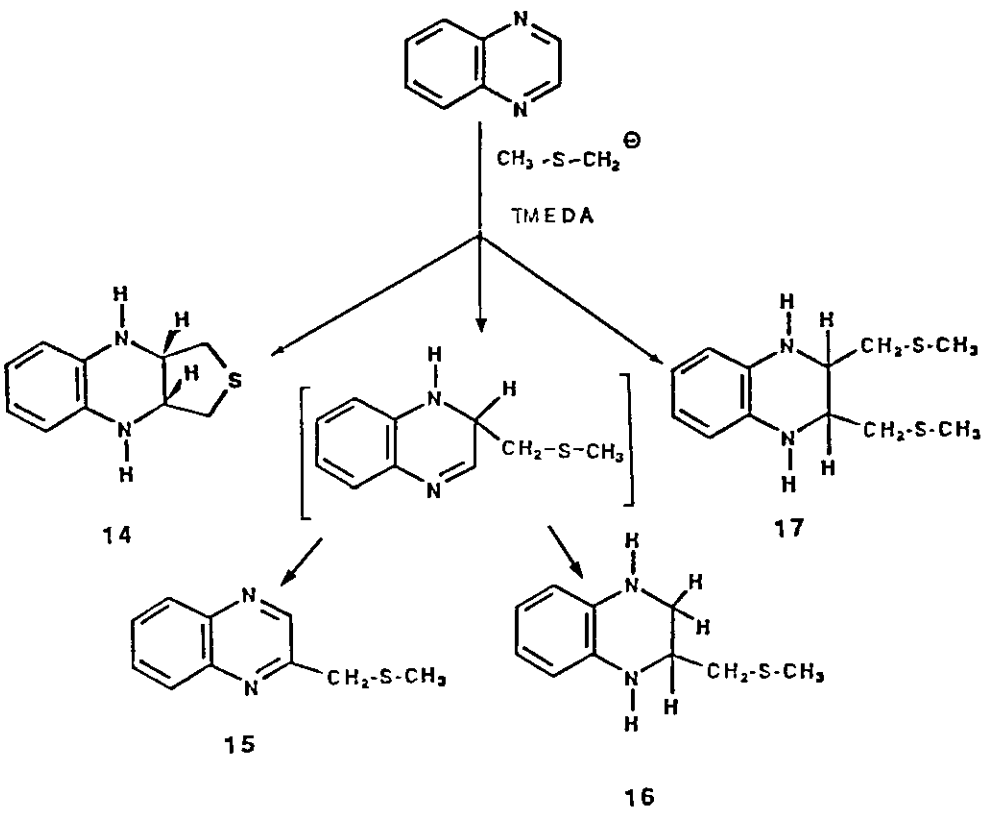
Structures and yields of isomers isolated in the condensation of sulfones and sulfoxides with quinoxaline are presented in Table III.

TABLE III

		C_1	C_3	C_{3a}	C_{9a}	Yield %
5	β	H	H	H	H	48 %
	α	Pr	Pr			
6	β	Pr	H	H	H	33 %
	α	H	Pr			
7	β	H	H	H	H	42 %
	α	Me	Pr			
8	β	Me	H	H	H	13 %
	α	H	Pr			
9	β	H	Pr	H	H	12 %
	α	Me	H			
10	β	Me	Pr	H	H	9 %
	α	-Q (*)	H			
12	β	H	H	H	H	42 %
	α	SCH_3	H			
13	β	SCH_3	H	H	H	12 %
	α	H	H			

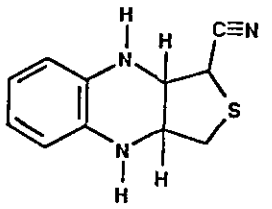
(*) Q = Quinoxaline

It can be seen that the preponderant isomer is always the one with H_1, H_3, H_{3a} and H_{9a} β, other substituents (CH_3, C_3H_7, SCH_3) being α (pseudoequatorial preferential configuration). The reaction of dimethyl sulfide with quinoxaline could be performed according to the described procedure, with the addition of tetramethylethylenediamine (TMEDA) for the metalation step. At -70°C, three compounds were obtained from the reaction mixture : 14 (1 %), 15 (30 %), 16 (10 %). When the reaction was performed at 20°C, the diadduct 17 (32 %) was also isolated. The compounds 15 and 16 were probably formed by an oxydo reduction reaction from the unstable monoadduct (see Scheme 2).



Scheme 2

The annelation product 14 was formed in very poor yield (1 %). However, monosubstitution (15 and 16) and even disubstitution (17) were easier than in the analogous reactions of sulfones and sulfoxides. The same difficulties were encountered with methyl cyanomethyl sulfide : only 1 % of the annelation product 18 could be isolated.



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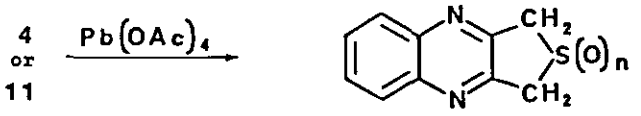
The following aspects of the reactivity of sulfone 4 and sulfoxide 11 were studied : Lead tetracetate oxidation led to aromatization of the tetrahydropyrazinic moiety, affording 19a and 19b ; compound 19b has been described previously [5] ;



19a n = 2

b n = 1

Reduction of sulfoxide 11 by $NaBH_2S_3$ [6] gave the sulfide 14 (68 % yield).

EXPERIMENTAL

Melting points were determined on a Kofler hot stage apparatus and are uncorrected. ^1H Nmr spectra were recorded on VARIAN T 60 and BRUKER AM 250 spectrometers and ^{13}C nmr on a VARIAN CFT 20 instrument. Chemical shifts are expressed in ppm relative to tetramethylsilane as internal standard. Mass spectra were determined on a VG 70-70F mass spectrometer (SAMM Centre d'Etudes Pharmaceutiques Châtenay-Malabry). Elemental analyses were determined with a Perkin Elmer 240 model automatic analyser.

1,3,3a,4,9,9a-Hexahydrothieno[3,4-b]quinoxaline 2,2-Dioxide (4).

To a stirred solution of 0.02 mol (1.88 g) of dimethyl sulfone in 50 ml of freshly distilled tetrahydrofuran was added 0.02 mol of butyllithium (12.5 ml of 1.6 M butyllithium in hexane), and after 30 min at room temperature 0.02 mol (2.6 g) of quinoxaline. After 4 h, 2 ml of distillated water were added. The reaction mixture was evaporated to dryness, then

fractionated by elution from a column of silica gel 60 (MERCK 70-230 mesh ASTM) with CH_2Cl_2.

Yield : 82 %. mp : 208°C (ethanol). Ms (m/z) : 224 (M^+). ^1H nmr ($DMSOd_6$, 60 MHz) and ^{13}C nmr ($DMSOd_6$) : Table I. Anal. Calcd for $C_{10}H_{12}N_2O_2S$: C, 53.55 ; H, 5.39 ; N, 12.49. Found : C, 53.50 ; H, 5.51 ; N, 12.34.

1,3-Dipropyl-1,3,3a,4,9,9a-hexahydrothieno[3,4-b]quinoxaline 2,2-Dioxide.

This compound was prepared from dibutyl sulfone (0.02 mol, 3.56 g) as described for compound 4 and fractionated by column chromatography using hexane-ethyl acetate (9/1 then 8/2).

Isomer (5)

White crystalline powder. Yield : 46 %. mp : 84°C (ethanol). Ms (m/z) : 309 (M+1), 308 (M^+) ^1H nmr ($CDCl_3$, 250 MHz) and ^{13}C nmr ($CDCl_3$) : Table I. Anal. Calcd for $C_{16}H_{24}N_2O_2S$: C, 62.31 ; H, 7.84 ; N, 9.08. Found : C, 62.52 ; H, 7.87 ; N, 8.89.

Isomer (6)

White powder. Yield : 33 %. mp : 91°C (ethanol). Ms (m/z) : 309 (M+1), 308 (M^+). ^1H nmr ($CDCl_3$, 250 MHz) and ^{13}C nmr ($CDCl_3$) : Table I. Anal. Calcd for $C_{16}H_{24}N_2O_2S$: C, 62.31 ; H, 7.84 ; N, 9.08. Found : C, 62.26 ; H, 8.04 ; N, 9.01.

1-Methyl-3-propyl-1,3,3a,4,9,9a-hexahydrothieno[3,4-b]quinoxaline 2,2-Dioxide.

This compound was prepared from ethyl butyl sulfone (0.02 mol, 3 g) as described for compound 4. The chromatography column was eluted with hexane-ethyl acetate (8/2).

Isomer (7)

White powder. Yield : 42 %. mp : 134°C (ethanol). ^1H nmr ($CDCl_3$, 250 MHz) and ^{13}C nmr ($CDCl_3$) : Table I. Anal. Calcd for $C_{14}H_{20}N_2O_2S$: C, 59.98 ; H, 7.19 ; N, 9.99. Found : C, 59.77 ; H, 6.98 ; N, 9.81.

Isomer (8)

White powder. Yield : 13 %. mp : 161°C (ethanol). Ms (m/z) : 280 (M^+). ^1H nmr ($CDCl_3$, 250 MHz) and ^{13}C nmr ($CDCl_3$) : Table I. Anal. Calcd for $C_{14}H_{20}N_2O_2S$: C, 59.98 ; H, 7.19 ; N, 9.99. Found : C, 59.77 ; H, 7.32 ; N, 9.82.

Isomer (9)

White powder. Yield : 12 %. mp : 174°C (ethanol). ^1H nmr ($CDCl_3$, 250 MHz) and ^{13}C nmr ($CDCl_3$) : Table I. Anal. Calcd for $C_{14}H_{20}N_2O_2S$: C, 59.98 ; H, 7.19 ; N, 9.99. Found : C, 60.11 ; H, 7.30 ; N, 9.81.

Isomer (10)

Pyrrolo([4,5-b]1',2',3',4'-tetrahydroquinoxaline)[1,2,3-lm]-1-methyl-3-propyl-1,3,3a,4,9,9a-hexahydrothieno[3,4-b]quinoxaline 2,2-Dioxide.

Yellow powder. Yield : 9 %. mp : 255°C (ethanol). Ms (m/z) : 410 (M^+). ^1H nmr ($CDCl_3$, 250 MHz) and ^{13}C nmr ($CDCl_3$) : Table I. Anal. Calcd for $C_{22}H_{26}N_4O_2S$: C, 64.36 ; H, 6.38 ; N, 13.65. Found : C, 64.24 ; H, 6.61 ; N, 13.29.

1,3,3a,4,9,9a-Hexahydrothieno[3,4-b]quinoxaline 2-Oxide (11).

This compound was prepared from dimethyl sulfoxide (0.02 mol, 1.46 g) as described for compound 4. It was isolated by column chromatography on silica gel, ethyl acetate-methanol (9/1) being used for elution.

White powder. Yield : 51 %. mp : 252°C (ethanol). Ms (m/z) : 208 (M^+). ^1H nmr ($DMSOd_6$, 60 MHz) : 6.60-6.40 (m, 4H) ; 5.70 (m, 2H exchanged by D_2O) ; 3.90-3.60 (m, 2H) ; 3.50-3.30 (m, 2H) ; 2.70-2.40 (m, 2H). ^{13}C nmr ($DMSOd_6$) : 52.8 (2d, C_{3a}, C_{9a}) ; 56.3 (2t, C_1, C_3) ; 113.8 (2d, C_5, C_8) ; 117.5 (2d, C_6, C_7) ; 131.5 (2s, C_{4a}, C_{8a}). Anal. Calcd for $C_{10}H_{12}N_2OS$: C, 57.67 ; H, 5.81 ; N, 13.45. Found : C, 57.73 ; H, 5.93 ; N, 13.32.

1-Methylthio-1,3,3a,4,9,9a-hexahydrothieno[3,4-b]quinoxaline 2-Oxide.

This compound was prepared from methyl sulfinylmethyl sulfide (0.02 mol, 2.48 g) as described for compound 4 and chromatographed on silica gel using ethyl acetate then ethyl acetate-methanol (9/1) as eluent.

Isomer (12)

White powder. Yield : 42 %. mp : 180°C (ethanol). Ms (m/z) : 254 (M^+). ^1H nmr ($DMSOd_6$, 250 MHz) and ^{13}C nmr ($DMSOd_6$) : Table II. Anal. Calcd for $C_{11}H_{14}N_2OS_2$: C, 51.94 ; H, 5.55 ; N, 11.01. Found : C, 51.93 ; H, 5.63 ; N, 11.03.

Isomer (13)

White powder. Yield : 12 %. mp : 231°C (ethanol). Ms (m/z) : 254 (M^+). ^1H nmr ($DMSOd_6$, 250 MHz) and ^{13}C nmr ($DMSOd_6$) : Table II. Anal. Calcd for $C_{11}H_{14}N_2OS_2$: C, 51.94 ; H, 5.55 ; N, 11.01. Found : C, 51.76 ; H, 5.54 ; N, 11.04.

1,3,3a,4,9,9a-Hexahydrothieno[3,4-b]quinoxaline (14).

To a stirred solution of 0.05 mol of butyllithium (31.5 ml, 1.6 M butyllithium in hexane) was added dropwise 0.05 mol (5.8 g) of TMEDA, then at 0°C, 0.05 mol (3.1 g) of dimethyl sulfide. The reaction mixture was stirred for 4 h at room temperature, then cooled to -70°C, and 0.05 mol (6.5 g) of quinoxaline in 30 ml of freshly distilled THF was added.

After 4 h at room temperature, distilled water (2 ml) was added. The reaction mixture was evaporated to dryness and chromatographed on silica gel using CH_2Cl_2 as eluent.
This compound was also obtained from product 11 by reduction : to a stirred solution of 0.015 mol of $NaBH_2S_3$ in 150 ml of THF [LALANCETTE reactif [6]] was added 0.004 mol of compound 11. After 4 h at room temperature the excess of $NaBH_2S_3$ was neutralized with 5 ml of ethanol. The reaction mixture was evaporated to dryness and chromatographed on silica gel (elution with CH_2Cl_2). Yield : 68 %.
White crystals. Yield : 1 %. mp : 164°C (ethanol). Ms (m/z) : 192 (M^+). ^1H nmr ($CDCl_3$, 60 MHz) : 6.60 (m, 4H) ; 4.00-3.80 (m, 2H) ; 3.80-3.60 (m, 2H exchanged by D_2O) ; 3.20-2.70 (m, 4H). ^{13}C nmr ($DMSOd_6$) : 33.6 (2t, C_1, C_3) ; 55.7 (2d, C_{3a}, C_{9a}) ; 113.9 (2d, C_5, C_8) ; 117.8 (2d, C_6, C_7) ; 132.6 (2s, C_{4a}, C_{8a}). Anal. Calcd for $C_{10}H_{12}N_2S$: C, 62.46 ; H, 6.29 ; N, 14.57. Found : C, 62.48 ; H, 6.22 ; N, 14.64.

2-(Methylthiomethyl)quinoxaline (15).

Isolated from the abovementioned reaction mixture.
Unstable white crystals. Yield : 30 %. ^1H nmr ($CDCl_3$, 60 MHz) : 8.95 (s, 1H) ; 8.20-7.65 (m, 4H) ; 3.95 (s, 2H) ; 2.05 (s, 3H). Anal. Calcd for $C_{10}H_{10}N_2S$: C, 63.13 ; H, 5.30 ; N, 14.72. Found : C, 63.65 ; H, 5.62 ; N, 14.67.

2-(Methylthiomethyl)-1,2,3,4-tetrahydroquinoxaline (16).

Isolated from the abovementioned reaction mixture.
Unstable white powder. Yield : 10 %. Ms (m/z) : 194 (M^+). ^1H nmr ($CDCl_3$, 60 MHz) : 6.70-6.50 (m, 4H) ; 4.10-3.90 (m, 2H exchanged by D_2O) ; 3.60-3.20 (m, 3H) ; 2.80-2.50 (m, 2H) ; 2.10 (s, 3H). ^{13}C nmr ($CDCl_3$) : 15.1 (q, CH_3) ; 37.7 (t, CH_2) ; 45.2 (t, C_2) ; 47.7 (d, C_3) ; 114, 114.2, 118.3, 118.4 (4d, C_5, C_6, C_7, C_8) ; 132.4, 132.7 (2s, C_{4a}, C_{8a}). Anal. Calcd for $C_{10}H_{14}N_2S$: C, 61.82 ; H, 7.26 ; N, 14.42. Found : C, 61.99 ; H, 6.83 ; N, 13.99.

2,3-Bis (methylthiomethyl)-1,2,3,4-tetrahydroquinoxaline (17).

This product was obtained using the procedure described for 14, except that quinoxaline was added at room temperature.
Crystalline white powder. Yield : 32 %. mp : 72°C (ethanol). ^1H nmr ($CDCl_3$, 60 MHz) : 6.70-6.50 (m, 4H) ; 4.10-3.90 (m, 2H exchanged by D_2O) ; 3.55-3.25 (m, 2H) ; 2.80-2.50 (m, 4H) ; 2.20 (s, 6H). Anal. Calcd for $C_{12}H_{18}N_2S_2$: C, 56.66 ; H, 7.13 ; N, 11.01. Found : C, 56.70 ; H, 7.23 ; N, 10.95.

1-Cyano-1,3,3a,4,9,9a-hexahydrothieno[3,4-b]quinoxaline (18).

This compound was prepared from cyanomethyl methylsulfide (0.02 mol, 1.75 g) as described for compound 14.

White powder. Yield : 1 %. Ms (m/z) : 217 (M^+). ^1H nmr ($CDCl_3$, 60 MHz) : 8.10-7.80 (m, 1H exchanged by D_2O) ; 7.00-6.70 (m, 4H) ; 4.30 (m, 2H) ; 3.80 (m, 1H exchanged by D_2O) ; 2.40 (m, 3H).

1,3-Dihydrothieno[3,4-b]quinoxaline 2,2-Dioxide (19a).

To a stirred solution of 0.005 mol (1.12 g) of compound 4 in 50 ml of acetonitrile was added 0.01 mol (4.43 g) of lead tetracetate. After 30 min at room temperature, the mixture was treated with 30 ml of a saturated solution of Na_2CO_3. Solids were filtered off and washed with acetonitrile and ethyl acetate. The combined filtrate and washing were dried over anhydrous Na_2SO_4, concentrated to dryness and the residue was chromatographed on silica gel, elution with dichloromethane-ethyl acetate (9/1).

White crystals. Yield : 61 %. mp : 260°C (ethanol). Ms (m/z) : 220 (M^+). ^1H nmr ($DMSOd_6$, 60 MHz) : 8.25-7.80 (m, 4H) ; 5.10-5.00 (m, 4H). Anal. Calcd : C, 54.53 ; H, 3.66 ; N, 12.72. Found : C, 54.33 ; H, 3.87 ; N, 12.74.

1,3-Dihydrothieno[3,4-b]quinoxaline 2-Oxide (19b).

This compound was prepared from compound 11 0.005 mol (1.04 g) as described for compound 19a. It was isolated by column chromatography on silica gel, elution with ethyl acetate-methanol (8/2).

White powder. Yield : 88 %. mp : 158°C [mp : 157-158°C [5]]. ^1H nmr ($CDCl_3$, 60 MHz) : 8.25-7.60 (m, 4H) ; 4.55-4.35 (m, 4H). Anal. Calcd : C, 58.80 ; H, 3.95 ; N, 13.72. Found : C, 58.42 ; H, 4.09 ; N, 13.66.

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