On Triazoles. VII [1,2].
Synthesis of Novel Tri- and Tetracyclic Ring Systems.

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The ring-closure of the 5-amino-1-(2-aminophenyl)-3-methylthio-1*H*-1,2,4-triazole derivatives **3** and **4** with different simple and cyclic C_1 components lead to the formation of 1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepines **5-6**, their 4,5-dihydro- **7**, different 5-spiro-homocyclic- **8-13**, and 5-spiro-heterocyclic- **14-15** analogues. The structure of the compounds obtained was proved with the use of their ir, uv, ^{1}H-nmr and ^{13}C-nmr spectra.

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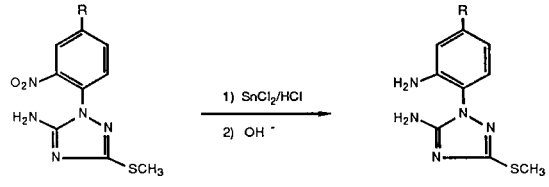
In a previous paper of this series [3] we have reported on the synthesis of 1-(2-nitrophenyl)-, and (2-nitro-4-trifluoromethylphenyl)-3-methylthio-5-amino-1*H*-1,2,4-triazole **1** and **2**, respectively. The reduction of these compounds with stannous chloride in concentrated hydrochloric acid [4] lead to the corresponding 1-(2-aminophenyl)-, and (2-amino-4-trifluoromethylphenyl)-3-methylthio-5-amino-1*H*-1,2,4-triazole derivatives **3** and **4**, respectively (Scheme 1), the two amino groups of which were cyclised with different C_1 components to give novel tri- and tetracyclic ring systems.

Scheme 1



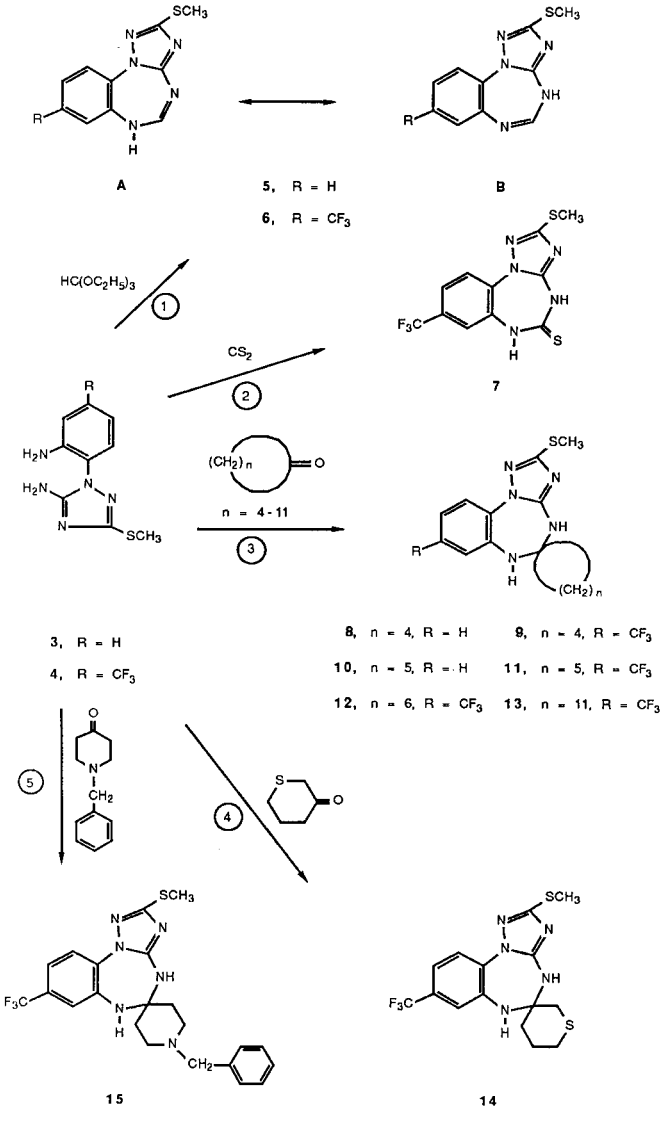
1, R = H
2, R = CF_3

3, R = H
4, R = CF_3

Thus the reaction of **3** and **4** with ethyl orthoformate lead to the formation of **5** and **6**, respectively (Scheme 2, Route 1), representing the novel 1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine ring system characterised by the CH singlets appearing at δ = 6.2 and 6.9, respectively, in the ^{1}H-nmr and the ν CN bands appearing at 1630 and 1640 cm^{-1}, respectively, in the ir.

Derivatives **5** and **6** may appear in the **A** and **B** tautomeric forms. The strong dependence of their uv spectra on the nature of the R group seems to indicate that the **A** (*i.e.* the 6*H*) tautomeric form is predominant in ethanolic solution. Structure **A** is in accordance with the chemical shifts

Scheme 2



of the triazole carbon atoms 2 and 3a of **6**, too, appearing at 157.5 and 162.0 ppm, respectively, being in good agreement with those of the [1-unsubstituted-, 1-phenyl, and 1-(2,6-dimethylphenyl)-3-methylthio-1*H*-1,2,4-triazole-5-yl]-iminodithiocarbonic acid dimethyl esters [5,6] appearing between 154.6-157.5 and 160.4-160.7 ppm, respectively. The reaction of **4** with carbon disulfide gave derivative **7** (Scheme 2, Route 2) containing again the novel 4,5-dihydro-6*H*-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine ring system the structure of which was characterised by the two ν NH bands at 3310 and 3220 cm^{-1} in the ir, the broad NH signals appearing at δ = 7.8 and 11 ppm, respectively, in the ^{1}H-nmr and the carbon signal appearing at δ = 186.8 ppm corresponding to the cyclic C=S carbon atom in the ^{13}C-nmr. Its dominant tautomeric structure shown in Scheme 2 is in accordance with the chemical shifts of the triazole carbon atoms 2 and 3a (δ = 156.0 and 163.1 ppm, respectively) being analogues with those obtained for 1-alkylated-3-alkylthio-5-amino-1*H*-1,2,4-triazoles (155.1-158.4 and 157.9-160.3, respectively) [3].

The reaction of **3** and **4** with different cyclic ketones (Scheme 2, Route 3) lead to the formation of derivatives **8-13**, respectively, representing the novel spiro[5,1′]cyclopenta- **8** and **9**, spiro[5,1′]cyclohexa- **10** and **11**, spiro[5,1′]-cycloheptа- **12** and spiro[5,1′]cycloduodeca- **13** -1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine ring systems. The structure of the above spiro-derivatives is well characterised -besides other spectral data - by the quaternary "spiro" carbon atoms appearing between 69.3 and 78.8 ppm in the ^{13}C-nmr and the two NH bands appearing at δ = 6.3-6.7 ppm and 8.1-8.6 ppm, respectively, in the ^{1}H-nmr. The dominant tautomeric structure of these derivatives shown on Scheme 2 is again in accordance with the chemical shifts of the triazole carbon atoms 2 and 3a (δ = 155.8-156.1 and 160.0-161.1 ppm, respectively) being again in excellent accordance with those of the analogues 1-alkylated-3-alkylthio-5-amino-1*H*-1,2,4-triazole derivatives (see above).

The reaction of **4** with heterocyclic ketones, *e.g.* with 3-thiacyclohexanone (Scheme 2, Route 4), or benzylpiperidone (Scheme 2, Route 5) lead again to the formation of compounds representing novel ring systems, namely the spiro[5,3′][thiacyclohexa]-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine (**14**) and the spiro[5,4′][1-benzylpiperidino]-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine (**15**) derivatives, respectively. Their structure is - besides the other spectral data - again in accordance with the two NH signals appearing in the ^{1}H-nmr, as well as with the chemical shifts of the "spiro" carbon atoms appearing in case of both derivatives at 67.8 ppm and the triazole carbon atoms 2 appearing at 155.6 and 156.2 ppm and those of 3a appearing at 161.6 and 161.3 ppm, respectively.

EXPERIMENTAL

Melting points were determined on a Koffler-Boëtius micro apparatus and are uncorrected. The infrared spectra were obtained as potassium bromide pellets using Perkin-Elmer 577 spectrophotometer. The ultraviolet spectra were obtained by a Varian Cary 118 and a Pye Unicam SP 8-150 instrument. The ^{1}H-nmr and the ^{13}C-nmr measurements were performed using Varian XL-100, Brucker WM-250 and Brucker WP-80 SY instruments.

5-Amino-1-(2-aminophenyl)-3-methylthio-1*H*-1,2,4-triazole (**3**).

To the mixture of 12.56 g (0.05 mole) of 5-amino-3-methylthio-1-(2-nitrophenyl)-1*H*-1,2,4-triazole (**1**) [3] and 100 ml of concentrated hydrochloric acid 79 g (0.35 mole) of tin(II) chloride was added in small portions while stirring and cooling the reaction mixture below 50°. The reaction was completed by boiling the mixture for 3 hours. After cooling the product crystallised as hydrochloride which was filtered off. The free base was liberated by partitioning the hydrochloride between the mixture of warm 300 ml of chloroform, 30 ml of methanol and 300 ml of 0.1 *N* sodium hydroxide. The layers were separated, the chloroform layer was dried over anhydrous sodium sulfate, evaporated to dryness and the residue re-crystallised from isopropanol to yield 6.4 g (58%) of the title compound, mp 128-129°; ir ν NH = 3450, 3420, 3310 and 3250 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 5.6 (b, 2H, NH_2), 6.4 (b, 2H, NH_2), 2.49 (s, 3H, SCH_3), 6.9-7.2 (m, 4H, ArH).

Anal. Calcd. for $C_9H_{11}N_5S$ (MW. 221.28): C, 48.85; H, 5.01; N, 31.65; S, 14.49. Found: C, 48.97; H, 5.06; N, 31.54; S, 14.65.

5-Amino-1-(2-amino-4-trifluoromethylphenyl)-3-methylthio-1*H*-1,2,4-triazole (**4**).

To the mixture of 9.57 g (0.03 mole) of 5-amino-3-methylthio-1-(2-nitro-4-trifluoromethylphenyl)-1*H*-1,2,4-triazole (**2**) [3] and 80 ml of concentrated hydrochloric acid 47.3 g (0.21 mole) ot tin(II) chloride was added in small portions while stirring and cooling the reaction mixture below 50°. The reaction was completed by boiling the mixture for 3 hours. After cooling the product crystallised as hydrochloride, which was filtered off. The free base was liberated by partitioning the hydrochloride between the mixture of warm 200 ml of chloroform, 20 ml of methanol and 200 ml of 0.1 *N* sodium hydroxide. The layers were separated, the chloroform layer dried over anhydrous sodium sulfate, evaporated to dryness and the residue re-crystallised from isopropanol to yield 5.6 g (65%) of the title compound, mp 216-217°; ir: ν NH = 3420, 3390, 3300 and 3210 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 5.6 (b, 2H, NH_2), 6.35 (bs, 2H, NH_2), 2.48 (s, 3H, SCH_3), 6.8-7.3 (m, 3H, ArH).

Anal. Calcd. for $C_{10}H_{10}F_3N_5S$ (MW. 289.28): C, 41.52; H, 3.48; N, 24.21; S, 11.08; F, 19.70. Found: C, 41.55; H, 3.67; N, 24.43; S, 11.00; F, 19.56.

2-Methylthio-6*H*-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine (**5**).

The solution of 2.21 g (0.01 mole) of 5-amino-1-(2-aminophenyl)-3-methylthio)-1*H*-1,2,4-triazole (**3**) in 15 ml of ethyl orthoformate was refluxed for 1.5 hours. After cooling the product crystallised was filtered off and re-crystallised from ethanol to yield 1.4 g (61%) of the title compound, mp 276-278°; ir : ν NH = 3220 cm^{-1}, ν C=N = 1630 and 1560 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 2.49 (s, 3H, SCH_3), 6.2 (s, 1H, CH(5)), 6.8-7.4 (m, 4H, ArH), 9.2 (b, 1H, NH); uv (ethanol): λ max (ϵ) 208 nm (21 900), 242 nm (14 100), 264 nm (14 600).

Anal. Calcd. for $C_{10}H_9N_5S$ (MW. 231.28): C, 51.93; H, 3.92; N, 30.28; S, 13.86. Found: C, 52.06; H, 4.04; N, 30.33; S, 13.96.

2-Methylthio-8-trifluoromethyl-6*H*-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine (**6**).

The mixture of 0.58 g (0.002 mole) of 5-amino-1-(2-amino-4-trifluoromethylphenyl)-3-methylthio-1*H*-1,2,4-triazole (**4**) and 5 ml of ethyl orthoformate was refluxed for 10 minutes. The product crystallised while hot was filtered off and re-crystallised from ethanol to yield 0.35 g (60%) of the title compound, mp 308-310°; ir: ν NH = 3230 cm^{-1}, ν C=N = 1650 and 1560 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 9.9 (b, 1H, NH), 6.7 (s,

1H, CH(5)), 6.9-7.6 (m, 3H, ArH), 2.51 (s, 3H, SCH_3), ^{13}C-nmr (DMSO-d_6): δ ppm 157.5 (C_2), 162.0 (C_{3a}), 151.9 (C_5); uv (ethanol): λ max (ε) 233 nm (15 600), 251 nm (17 200), 275 nm (20 900).

Anal. Calcd. for $C_{11}H_8F_3N_5S$ (MW. 299.28): C, 44.14; H, 2.69; N, 23.42; S, 10.71; F, 19.04. Found: C, 43.95; H, 2.52; N, 23.60; S, 10.90; F, 19.15.

4,5-Dihydro-2-methylthio-8-trifluoromethyl-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepin-5(6*H*)-thione (**7**).

To the solution of 2.9 g (0.01 mole) of 5-amino-1-(2-amino-4-trifluoromethylphenyl)-3-methylthio-1*H*-1,2,4-triazole (**4**) in 15 ml of pyridine 3.0 g (0.05 mole) of carbon disulfide was added and the reaction mixture refluxed while stirring for 10 hours. After cooling 50 ml of water was added dropwise at room temperature to the reaction mixture, the crystals precipitated were filtered off and re-crystallised from ethanol to yield 1.95 g (61%) of the title compound, mp 235-236.5°; ir: ν NH = 3310 and 3220 cm^{-1} ν C=N = 1630 and 1595 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 2.54 (s, 3H, SCH_3), 7.5-7.9 (m, 3H, ArH), 7.8 (b, 1H, NH), 11.5 (b, 1H, NH); ^{13}C-nmr (DMSO-d_6): δ ppm 186.8 (C_5-thione) 156.0 (C_2), 163.1 (C_{3a}); uv (2% DMF in ethanol): λ max (ε) 257 nm (24 200), 284 nm (22 000).

Anal. Calcd. for $C_{10}H_8F_3N_5S_2$ (MW. 319.34): C, 37.61; H, 2.53; N, 21.93; S, 20.08; F, 17.85. Found: C, 37.77; H, 2.60; N, 21.83; S, 20.11; F, 17.92.

4,5-Dihydro-2-methylthio-6*H*-spiro[5,1']cyclopenta-1,2,4-triazolo-[1,5-*a*]-1,3,5-benzotriazepine (**8**).

The mixture of 0.45 g (0.002 mole) of 5-amino-1-(2-aminophenyl)-3-methylthio-1*H*-1,2,4-triazole (**3**) and 5 ml of cyclopentanone was refluxed for 1 hour. The solution obtained was evaporated *in vacuo* to dryness and the residue was re-crystallised from ethyl acetate to yield 0.43 g (75%) of the title compound, mp 134-136°; ir: ν NH = 3340 and 3240 cm^{-1}; ν C=N = 1615 and 1590 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 1.6-2.0 (m, 8H, CH_2), 2.51 (s, 3H, SCH_3), 6.1 (s, 1H, NH), 8.3 (s, 1H, NH), 6.9-7.1 (m, 3H, ArH), 7.82 (d, 1H, ArH); ^{13}C-nmr (DMSO-d_6): δ ppm 78.8 (C_5-spiro), 156.1 (C_2), 160.0 (C_{3a}); uv (10% DMF in ethanol): λ max (ε) 273 nm (5 850), 300 nm (5 600).

Anal. Calcd. for $C_{14}H_{17}N_5S$ (MW. 287.39): C, 58.51; H, 5.96; N, 24.37; S, 11.16. Found: C, 58.70; H, 6.02; N, 24.31; S, 11.10.

4,5-Dihydro-2-methylthio-8-trifluoromethyl-6*H*-spiro[5,1']cyclopenta-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine (**9**).

The mixture of 0.58 g (0.002 mole) of 5-amino-1-(2-amino-4-trifluoromethylphenyl)-3-methylthio-1*H*-1,2,4-triazole (**4**) and 5 ml of cyclopentanone was refluxed for 2 hours. The solution obtained was evaporated *in vacuo* to dryness and the residue was re-crystallised from isopropanol to yield 0.50 g (71%) of the title compound, mp 180-182°; ir: ν NH = 3420, 3390, 3260 and 3180 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 1.7-1.9 (m, 8H, CH_2), 2.54 (s, 3H, SCH_3), 5.6 (b, 1H, NH), 8.6 (b, 1H, NH); ^{13}C-nmr (DMSO-d_6): δ ppm 78.6 (C_5-spiro), 156.7 (C_2), 161.4 (C_{3a}); uv (ethanol): λ max (ε) 215 nm (20 700), 235 nm (21 600), 280 nm (5 600), 312 nm (7 400).

Anal. Calcd. for $C_{15}H_{16}F_3N_5S$ (MW. 355.39): C, 50.69; H, 4.54; N, 19.71; S, 9.02; F, 16.04. Found: C, 50.91; H, 4.72; N, 19.59; S, 9.27; F, 16.22.

4,5-Dihydro-2-methylthio-6*H*-spiro[5,1']cyclohexa-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine (**10**).

5-Amino-1-(2-aminophenyl)-3-methylthio-1*H*-1,2,4-triazole (**3**) (1.35 g, 0.006 mole) was refluxed with 15 ml of cyclohexanone for 4 hours. The solution thus obtained was evaporated *in vacuo* to dryness and the residue was re-crystallised from isopropanol to yield 1.2 g (66%) of the title compound, mp 156-157°; ir: ν NH = 3350 and 3230 cm^{-1}, ν C=N = 1605 and 1580 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 1.2-1.7 (m, 10H, CH_2), 2.53 (s, 3H, SCH_3), 5.9 (s, 1H, NH), 8.0 (s, 1H, NH), 6.9-7.15 (m, 3H, ArH), 7.82 (d, 1H, ArH); ^{13}C-nmr (DMSO-d_6): δ ppm 69.8 (C_5-spiro), 155.8 (C_2), 160.1 (C_{3a}); uv (ethanol): λ max (ε) 229 nm (17 000), 273 sh nm (3 700), 296 nm (4 900).

Anal. Calcd. for $C_{15}H_{19}N_5S$ (MW. 301.41): C, 59.77; H, 6.35; N, 23.24; S, 10.64. Found: C, 59.99; H, 6.35; N, 23.00; S, 10.51.

4,5-Dihydro-2-methylthio-8-trifluoromethyl-6*H*-spiro[5,1']cyclohexa-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine (**11**).

The mixture of 0.58 g (0.002 mole) of 5-amino-1-(2-amino-4-trifluoromethylphenyl)-3-methylthio-1*H*-1,2,4-triazole (**4**) and 5 ml of cyclohexanone was refluxed for 1 hour. After cooling the product crystallised was filtered off and re-crystallised from 2-propanol to obtain 0.6 g (81%) of the title compound, mp 214-215°; ir: ν NH = 3350 and 3225 cm^{-1}, ν C=N = 1625 and 1590 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 1.3-1.7 (m, 10H, CH_2), 2.56 (s, 3H, SCH_3), 6.4 (s, 1H, NH), 8.3 (s, 1H, NH), 7.28-8.1 (m, 3H, ArH); ^{13}C-nmr (DMSO-d_6): δ ppm 69.3 (C_5-spiro), 156.2 (C_2) and 161.1 (C_{3a}); uv (ethanol): λ max (ε) 212 nm (26 400), 234 nm (21 700), 280 nm (5 800), 312 nm (4 900).

Anal. Calcd. for $C_{16}H_{18}F_3N_5S$ (MW. 369.41): C, 52.02; H, 4.91; N, 18.96; S, 8.68; F, 15.43. Found: C, 52.17; H, 5.06; N, 19.11; S, 8.55; F, 15.55.

4,5-Dihydro-2-methylthio-8-trifluoromethyl-6*H*-spiro[5,1']cyclohepta-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine (**12**).

The mixture of 1.45 g (0.005 mole) of 5-amino-1-(2-amino-4-trifluoromethylphenyl)-3-methylthio-1*H*-1,2,4-triazole (**4**) and 10 ml of cycloheptanone was refluxed for 12 hours. The solution obtained was evaporated to dryness, the residue partitioned between benzene and water, the benzene layer was dried over anhydrous sodium sulfate, evaporated to dryness and the residue re-crystallised from isopropanol to yield 0.92 g (57%) of the title compound, mp 156-158°; ir: ν NH = 3200 and 3110 cm^{-1}, ν C=N = 1660 and 1580 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 1.56-1.8 (m, 12H, CH_2), 2.56 (s, 3H, SCH_3), 6.5 (b, 1H, NH), 8.5 (b, 1H, NH), 7.28 (d, 1H, ArH), 7.57 (s, 1H, ArH), 8.06 (d, 1H, ArH); ^{13}C-nmr (DMSO-d_6): δ ppm 73.9 (C_5-spiro), 156.0 (C_2), 161.2 (C_{3a}); uv (ethanol): λ max (ε) 214 nm (20 400), 236 nm (18 800), 276 nm (4 850), 311 nm (6 350).

Anal. Calcd. for $C_{17}H_{20}F_3N_5S$ (MW. 383.45): C, 53.24; H, 5.26; N, 18.26; S, 8.36; F, 14.87. Found: C, 53.11; H, 5.31; N, 18.33, S, 8.42; F, 14.72.

4,5-Dihydro-2-methylthio-8-trifluoromethyl-6*H*-spiro[5,1']cycloduodeca-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine (**13**).

The mixture of 2.90 g (0.01 mole) of 5-amino-1-(2-amino-4-trifluoromethylphenyl)-3-methylthio-1*H*-1,2,4-triazole (**4**) and 9.05 g (0.05 mole) of cycloduodecanone was heated on an oil bath at 240° for 6 hours. The melt obtained was dissolved while hot in 25 ml of acetonitrile. After cooling the cystals precipitated were filtered off and re-crystallised from dimethylformamide to yield 2.1 g (46%) of the title compound, mp 199-200°; ir: ν NH = 3410 and 3240 cm^{-1}, ν C=N = 1618 and 1589 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 1.3-1.75 (m, 22H, CH_2), 2.52 (s, 3H, SCH_3), 6.35 (s, 1H, NH), 8.1 (s, 1H, NH), 7.4-8.1 (m, 3H, ArH); ^{13}C-nmr (DMSO-d_6): δ ppm 73.0 (C_5-spiro), 156.1 (C_2), 161.1 (C_{3a}); uv (ethanol): λ max (ε) 217 nm (17 900), 236 nm (19 500), 276 nm (5 450), 312 nm (6 650).

Anal. Calcd. for $C_{22}H_{30}F_3N_5S$ (MW. 453.57): C, 58.25; H, 6.67; N, 15.44; S, 7.07; F, 12.57. Found: C, 58.41; H, 6.76; N, 15.37; S, 7.02; F, 12.73.

4,5-Dihydro-2-methylthio-8-trifluoromethylphenyl-6*H*-spiro[5,3']thiacyclohexa-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine (**14**).

The mixture of 5.8 g (0.02 mole) of 5-amino-1-(2-amino-4-trifluoromethylphenyl)-3-methylthio-1*H*-1,2,4-triazole (**4**), 3.48 g (0.03 mole) of thiacyclohexane-3-one [7] and 10 ml of piperidine was refluxed for 15 hours. The reaction mixture was evaporated *in vacuo* to dryness and the residue was re-crystallised from dimethylformamide to yield 4.9 g (63%) of the title product, mp 204-206°; ir: ν NH = 3450 and 3390 cm^{-1}, ν C=N = 1645 and 1590 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 1.8-2.7 (m, 8H, CH_2), 2.54 (s, 3H, SCH_3), 6.5 (b, 1H, NH), 8.4 (b, 1H, NH), 7.35 (dd, 1H, ArH), 7.56 (d, 1H, ArH) and 8.01 (d, 1H, ArH); ^{13}C-nmr (DMSO-d_6): δ ppm 67.8 (C_5-spiro), 155.6 (C_2) and 161.6 (C_{3a}); uv (ethanol): λ max (ε) 215 nm (22 100), 235 nm (21 600), 282 nm (6 350), 309 nm (7 600).

Anal. Calcd. for $C_{15}H_{16}F_3N_5S$ (MW. 387.46): C, 46.50; H, 4.16; N, 18.08; S, 16.55, F, 14.71. Found: C, 46.44; H, 4.22; N, 18.20; S, 16.40; F, 14.80.

4,5-Dihydro-2-methylthio-8-trifluoromethyl-6*H*-spiro[5,4']-(1-benzylpiperidino)-1,2,4-triazolo[1,5-*a*]-1,3,5-benzotriazepine (**15**).

The mixture of 2.90 g (0.01 mole) of 5-amino-1-(2-amino-4-trifluoromethylphenyl)-3-methylthio-1*H*-1,2,4-triazole (**4**) and 10 ml of 1-benzylpiperidin-4-one [8] was heated to 180° for 16 hours. The reaction mixture thus obtained was evaporated to dryness and the residue re-crystallised from acetonitrile to yield 3.03 g (66%) of the title product, mp 188-190°; ir: ν NH = 3230 cm^{-1}, ν C=N = 1622 and 1593 cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ ppm 2.47 (t, 4H, CH_2), 2.52 (s, 3H, SCH_3), 3.48 (s, 2H, NCH_2), 3.36 (m, overlaped by solvent, NCH_2), 6.5 (bs, 1H, NH), 8.4 (bs, 1H, NH), 7.25-8.0 (m, 8H, ArH); ^{13}C-nmr (DMSO-d_6): δ ppm 67.8 (C_5-spiro), 156.2 (C_2), 161.3 (C_{3a}); uv (ethanol): λ max (ϵ) 216 nm (20 700), 235 nm (21 000), 279 nm (5 850), 311 nm (7 300).

Anal. Calcd. for $C_{22}H_{23}F_3N_6S$ (MW. 460.53): C, 57.38; H, 5.03; N, 18.25; S, 6.96; F, 12.38. Found: C, 57.20; H, 5.10; N, 18.30; S, 7.02; F, 12.19.

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