Studies on 1,2,3-Triazoles. Part XI. A New Entry to the Benzopyrano[2,3-*d*]-1,2,3-triazole System. Cyclization of 1-Benzyl-5-chloro-4-(2-hydroxybenzoyl)-1*H*-1,2,3-triazoles [1]

Derek R. Buckle

Beecham Pharmaceuticals, Research Division, Biosciences Research Centre, Great Burgh, Yew Tree Bottom Road, Epsom, Surrey, KT18 5XQ, England

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The acylation of simple arenes such as benzene and alkylated benzenes with *N*-protected 5-chloro-1*H*-1,2,3-triazole-4-carboxylic acid chlorides under Friedel-Crafts conditions results in excellent yields of the corresponding ketones. Resorcinol dimethyl ethers undergo similar acylation reactions in somewhat lower yield with concomitant monodemethylation, and these derivatives undergo a facile base mediated cyclization to 9-oxo-3*H*,9*H*-benzopyrano[2,3-*d*]-1,2,3-triazoles.

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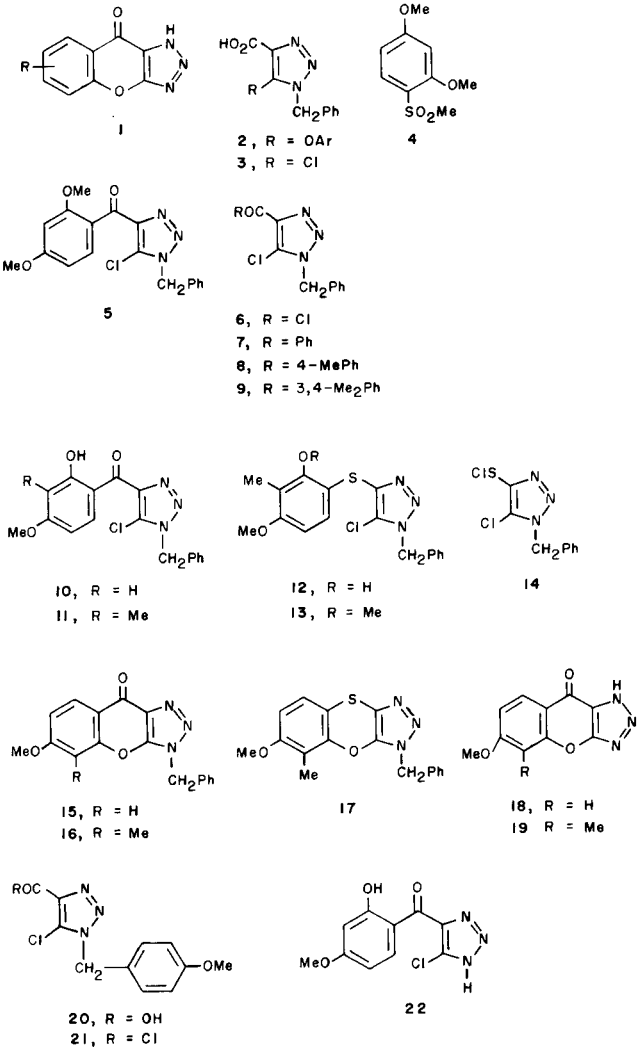
Despite the vast literature on 1,2,3-triazoles [2] there appears to be remarkably little known regarding the acylation at a carbon centre with 1,2,3-triazole carboxylic acids or their acyl halides. Whereas examples of the intramolecular cyclization of both *N*-unsubstituted and *N*-protected anilino [3], phenoxy [4] and phenylthio [1] triazole carboxylic acid derivatives have been reported by our group, there are few examples in which intermolecular acylation reactions of a similar type have been demonstrated [5]. In our search for alternative routes to biologically active tricyclic triazoles such as **1** [4] we considered that suitably substituted benzoyl-1,2,3-triazoles, formed by the direct acylation of an appropriate arene, might offer the opportunity of forming the pyranone ether bond as the terminal step.

The utility of phosphoric oxide in methanesulphonic acid for the cyclization of 5-aryloxy-1,2,3-triazole-4-carboxylic acids **2** has been previously demonstrated [4] and it seemed possible that this reagent might also facilitate the intermolecular acylation of suitable arenes with *N*-protected triazole carboxylic acids such as **3**. However, reaction of **3** with 1,3-dimethoxybenzene under these conditions led only to the formation of the methanesulphonyl derivative **4** (56% yield), which presumably arises from methanesulphonic anhydride produced in the reaction mixture [6, 7]. No evidence for the formation of the expected product **5** was found and the triazole **3** was recovered unchanged from the reaction. Under the more vigorous Lewis acid catalysed Friedel-Crafts conditions the acyl halide **6**, formed from **3** by treatment with oxalyl chloride in dichloromethane, reacted well with simple benzenoid compounds to give good yields of the corresponding ketones. For example, in the presence of aluminium chloride, **6** reacted with benzene, toluene and *o*-xylene at room temperature to give 77-100% yields of the respective ketones **7-9**.

The acylation of 1,3-dimethoxybenzene with **6** was also effective but necessitated the use of a diluent and a much reduced molar excess of the arene. Under these conditions lower yields (*ca* 64%) of the ketone **10** were produced, although the reaction required considerably longer to effect optimal conversion. The concomitant demethylation of the *ortho*-methoxy group under these conditions was not alto-



gether unexpected and is a recognised feature of *ortho*-alkoxy ketones in the presence of Lewis acids [8].

A similar reaction with 2,6-dimethoxytoluene, in which the acyl halide **6** was prepared with refluxing thionyl chloride, gave only low yields (*ca* 9%) of the corresponding ketone **11** which was frequently difficult to separate from chromatographically similar impurities. Indeed, on two occasions, acyl halide **6** formed from **3** with thionyl chloride, resulted in the additional isolation of two unusual sulphur containing products. Analysis of their spectral and combustion data showed these to be the phenol **12**, isolated in 23% yield, and the dimethyl ether **13**, isolated in 5% yield. Sulphur insertion reactions with thionyl chloride have been reported with other systems [9] and it seems likely that **12** and **13** are derived from an intermediate sulphenyl chloride such as **14**. These sulphur containing products were simply avoided by using oxalyl chloride for the formation of the acyl halide **6** when the expected ketone **11** was formed in reasonable yield (52%).

Both **10** and **11** were readily cyclized by treatment with one equivalent of sodium hydride and warming in *N,N*-dimethylformamide when near quantitative yields of the respective tricyclic derivatives **15** and **16** could be isolated. An analogous reaction with the sulphur compound **12** afforded only 27% of the novel heterocyclic system **17**, presumably on account of the reduced activation of the halogen towards nucleophilic displacement in this instance.

Although earlier work had shown that attempted hydrogenolysis of the benzyl substituent of 3-benzyl-9-oxo-3*H*,9*H*-benzopyrano[2,3-*d*]-1,2,3-triazole resulted only in disruption of the triazole ring [4], more recent work has shown that the use of a specific palladium catalyst can effect its removal under comparatively mild conditions [10]. Thus, hydrogenolysis of both **15** and **16** under these conditions resulted in smooth cleavage of the *N*-benzyl groups to give moderate yields of the respective *N*-unsubstituted compounds **18** and **19**, although separation of **19** from other cleavage products was difficult.

The facile cleavage of the *N*-(4-methoxybenzyl) groups from 1,2,3-triazoles under non-hydrogenolytic conditions [11] suggested that this might also be a suitable protecting group for the formation of compounds of type **1**. Thus, the reaction of **20** with oxalyl chloride readily generated the acyl halide **21** which was reacted with 1,3-dimethoxybenzene as described for compound **6**. Under the extended reaction times necessary to effect acylation, however, the protecting group was also cleaved such that only the *N*-unsubstituted ketone **22** (58% yield) was isolated. Attempts to cyclize **22** under basic conditions were ineffective, presumably due to the acidic nature of the unprotected triazole nucleus, and further attempts to utilize the 4-methoxybenzyl group for this approach were discontinued.

EXPERIMENTAL

Melting points were determined using a Büchi apparatus and are recorded uncorrected. The ir spectra were measured for dispersions in Nujol (Perkin-Elmer 197 spectrophotometer) unless otherwise specified. The pmr spectra were determined with a Varian EM 390 (90 MHz) spectrometer for solutions in the indicated solvents with TMS as an internal standard. Mass spectra were measured using a VG Micromass 70-70F spectrometer using electron impact ionization.

1-Benzyl-5-chloro-1*H*-1,2,3-triazole-4-carboxylic Acid (**3**).

A mixture of 20.0 g (75 mmoles) of ethyl 1-benzyl-5-chloro-1*H*-1,2,3-triazole-4-carboxylate [4] and 300 ml of 1*M* aqueous sodium hydroxide was stirred for 1.5 hours at 85° and the resulting clear solution was cooled in ice and acidified. The precipitated solid was filtered off, dried and recrystallized from ethyl acetate to give 14.95 g (84%) of the acid **3**, mp 140-141° dec; ir: 2600 (br), 1725, 1545 cm^{-1}; nmr (DMSO-d_6): δ 5.68 (s, CH_2, 2H), 7.32 (m, aromatic, 5H).

Anal. Calcd. for $C_{10}H_8ClN_3O_2$: C, 50.55; H, 3.4; N, 17.7; Cl, 14.9. Found: C, 50.4; H, 3.15; N, 17.55; Cl, 14.8.

Attempted Acylation of 1,3-Dimethoxybenzene with **3**.

To a stirred solution of 3.5 g of phosphoric oxide in 15 g of methanesulphonic acid at 60-70° was added 0.475 g (2 mmoles) of **3** and 0.276 g (2 mmoles) of 1,3-dimethoxybenzene and the mixture was stirred at this temperature for 3 hours. The cooled mixture was poured into ice-water and extracted with ethyl acetate. The organic phase was washed with water, dried over magnesium sulphate and evaporated under reduced pressure to a dark crystalline solid. Chromatography of this residue on silica with chloroform gave 0.240 g (56%) of 1,3-dimethoxy-4-methanesulphonylbenzene (**4**), mp 108-109° from toluene-petroleum ether (bp 40-60°) (lit [7] mp 105°); ir: 1603, 1580, 1470, 1295, 1285 cm^{-1}; nmr (deuteriochloroform): δ 3.18 (s, SO_2CH_3, 3H), 3.88 (s, OCH_3, 3H), 3.97 (s, OCH_3, 3H), 6.52 (m, H-2, H-3, 2H), 7.85 (d, H-5, 1H, J = 10 Hz).

Anal. Calcd. for $C_9H_{12}O_4S$: C, 50.0; H, 5.6; S, 14.85. Found: C, 50.2; H, 5.75; S, 15.1.

Further elution with methanol-chloroform (1:1) afforded, after recrystallization, 0.40 g of unchanged **3**.

4-Benzoyl-1-benzyl-5-chloro-1*H*-1,2,3-triazole (**7**).

To a stirred solution of 2.37 g (10 mmoles) of **3** and 2.54 g (2-fold excess) of oxalyl chloride in 50 ml of dichloromethane was added 2 drops of dry *N,N*-dimethylformamide. The mixture was stirred at room temperature for 2 hours and the solvent and excess oxalyl chloride were evaporated under reduced pressure to give crude acid chloride **6**; ir (film): 1760 cm^{-1} (C=O), which was used without further purification. Benzene (50 ml) was added to the crude acyl halide and the resulting solution was stirred at 7-8° during the portionwise addition of 4.0 g (30 mmoles) of powdered anhydrous aluminium chloride over 15 minutes. The mixture was stirred for a further 2 hours following the addition during which time the temperature rose to *ca* 20° and the mixture was poured onto iced 5*N* hydrochloric acid. The product was extracted into ethyl acetate and the extracts were dried over magnesium sulphate and evaporated to a crystalline solid. Recrystallization from toluene-petroleum ether (bp 40-60°) gave 2.30 g (77%) of ketone **7**, mp 88-89°; ir: 1745, 1610, 1460, 1240 cm^{-1}; nmr (deuteriochloroform): δ 5.62 (s, CH_2, 2H), 7.40 (s, benzyl aromatics, 5H), 7.52 (m, benzoyl H-3, H-4, H-5, 3H), 8.32 (m, benzoyl H-2, H-6, 2H).

Anal. Calcd. for $C_{16}H_{12}ClN_3O$: C, 64.55; H, 4.05; N, 14.1; Cl, 11.9. Found: C, 64.35; H, 4.3; N, 14.45; Cl, 12.3.

1-Benzyl-5-chloro-4-(4-methylbenzoyl)-1*H*-1,2,3-triazole (**8**).

Reaction of compound **6** with toluene as described above for compound **7** afforded 87% of **8** after chromatography on silica gel with chloroform elution. Recrystallization from toluene-petroleum ether (bp 40-60°) gave material mp 73-75°; ir: 1638, 1603, 1490, 1235, 1150 cm^{-1}; nmr (deuteriochloroform): δ 2.43 (s, CH_3, 3H), 5.60 (s, CH_2, 2H), 7.40 (s,

benzyl aromatics, 5H), 7.75 (ABq, benzoyl aromatics, 4H, J = 9 Hz, $\Delta\nu$ = 87 Hz).

Anal. Calcd. for $C_{17}H_{14}ClN_3O$: C, 65.5; H, 4.55; N, 13.5; Cl, 11.35. Found: C, 65.45; H, 4.75; N, 13.45; Cl, 11.7.

1-Benzyl-5-chloro-4-(3,4-dimethylbenzoyl)-1*H*-1,2,3-triazole (**9**).

A similar reaction of **6** with *o*-xylene as described for compound **7** gave **9** in quantitative yield. Recrystallization from toluene-petroleum ether (bp 40-60°) gave material mp 108-109°; ir: 1640, 1598, 1490, 1485 cm^{-1}; nmr (deuteriochloroform): δ 2.32 (s, CH_3, 6H), 5.58 (s, CH_2, 2H), 7.22 (m, benzoyl H3, 1H),7.33 (s, benzyl aromatics, 5H), 8.08 (m, benzoyl H-2, H-6, 2H).

Anal. Calcd. for $C_{18}H_{16}ClN_3O$: C, 66.35; H, 4.95; N, 12.9; Cl, 10.9. Found: C, 66.2; H, 4.85; N, 13.05; Cl, 10.85.

1-Benzyl-5-chloro-4-(2-hydroxy-4-methoxybenzoyl)-1*H*-1,2,3-triazole (**10**).

To a solution of **6** (10 mmoles, prepared from **3** with oxalyl chloride as described above) in 50 ml of dry dichloromethane was added 1.38 g (10 mmoles) of 1,3-dimethoxybenzene and the mixture was cooled to 0°. Powdered anhydrous aluminium chloride (4.05 g, 3 equivalents) was added portionwise over 15 minutes with stirring and the mixture was stirred for 30 hours at room temperature. Work up as described for compound **7** followed by chromatography on silica with chloroform gave 2.19 g (64%) of **10** as a pale yellow solid. Recrystallisation from ethanol gave pure material, mp 133°; ir: 1618, 1580, 1500, 1460, 1250 cm^{-1}; nmr (deuteriochloroform): δ 3.81 (s, OCH_3, 3H), 5.55 (s, CH_2, 2H),6.37 (bs, benzoyl H-3, 1H), 6.42 (d d, benzoyl H-5, 1H, $J_{3,5}$ = 1.5 Hz, $J_{5,6}$ = 9.5 Hz), 7.32 (s, benzyl aromatics, 5H), 8.77 (d d, benzoyl H-6, 1H, $J_{3,6}$ = *ca* 1 Hz, $J_{5,6}$ = 9.5 Hz), 12.7 (s, OH, 1H).

Anal. Calcd. for $C_{17}H_{14}ClN_3O_3$: C, 59.4; H, 4.1; N, 12.2; Cl, 10.35. Found: C, 59.1; H, 3.7; N, 12.25; Cl, 10.7.

1-Benzyl-5-chloro-4-(2-hydroxy-4-methoxy-3-methylbenzoyl)-1*H*-1,2,3-triazole (**11**).

Reaction of the acyl halide **6**, prepared from the acid **3** with neat refluxing thionyl chloride for 2-3 hours, with 2,6-dimethoxytoluene as described for the homologue **10** gave, after chromatography on silica with chloroform and recrystallization from ethanol, 9% of the ketone **11** as a yellow crystalline solid, mp 134-135°; ir: 1620, 1595, 1490, 1260, 1125 cm^{-1}; nmr (deuteriochloroform): δ 2.10 (s, aromatic CH_3, 3H), 3.88 (s, OCH_3, 3H), 5.55 (s, CH_2, 2H), 6.49 (s, benzoyl H-5, 1H, J = 9 Hz), 7.32 (s, benzyl aromatics, 5H), 8.63 (d, benzoyl H-6, 1H, J = 9 Hz), 12.75 (s, OH, 1H).

Anal. Calcd. for $C_{18}H_{16}ClN_3O_3$: C, 60.4; H, 4.5; N, 11.75; Cl, 9.9. Found: C, 60.35; H, 4.05; N, 11.85; Cl, 10.1.

On two occasions a similar reaction afforded two sulphur containing products which were separable by chromatography on silica with chloroform. Under these conditions compound **11** (6%) eluted first followed by 1-benzyl-5-chloro-4-(2-hydroxy-4-methoxy-3-methylphenylthio)-1*H*-1,2,3-triazole, **12**, (23%), mp 71-73° (from ethanol); ir: 3450 (sharp), 1595, 1575, 1480, 1100 cm^{-1}; nmr (deuteriochloroform): δ 2.09 (s, aromatic CH_3, 3H), 3.74 (s, OCH_3, 3H), 5.39 (s, CH_2, 2H), 6.35 (d, phenylthio H-5, 1H, J = 9 Hz), 7.28 (m, benzyl aromatics, 5H), *ca*, 7.20 (OH, 1H), 7.40 (d, phenylthio H-6, 1H, J = 9 Hz); ms: 361 (M^+, 55), 242 (90), 215 (20), 206 (12), 181 (75), 91 (100).

Anal. Calcd. for $C_{17}H_{16}ClN_3O_2S$: C, 56.45; H, 4.45; N, 11.6; S, 8.55; Cl, 9.8. Found: C, 56.55; H, 4.35; N, 11.45; S, 8.65; Cl, 10.1.

Further elution gave 1-benzyl-5-chloro-4-(2,4-dimethoxy-3-methylphenylthio)-1*H*-1,2,3-triazole, **13**, (5%), mp 83-85° (from ethanol); ir: 1580, 1575, 1470, 1260, 1105, 720 cm^{-1}; nmr (deuteriochloroform): δ 2.11 (s, aromatic CH_3, 3H), 3.72 (s, OCH_3, 3H), 3.82 (s, OCH_3, 3H), 5.48 (s, CH_2, 2H), 6.48 (d, phenylthio H-6, 1H, J = 9 Hz), 6.95 (d, phenylthio H-5, 1H, J = 9 Hz), 7.28 (s, benzyl aromatics, 5H); ms: 375 (M^+, 82), 332 (58), 215 (60), 182 (52), 91 (100), 69 (72).

Anal. Calcd. for $C_{18}H_{18}ClN_3O_2S$: C, 57.5; H, 4.85; N, 11.2. Found: C, 57.9; H, 4.65; N, 11.10.

By replacing thionyl chloride by oxalyl chloride in the preparation of **6** a much cleaner reaction took place and 52% of pure **11** was isolated when acylation was allowed to proceed for 48 hours at room temperature.

3-Benzyl-6-methoxy-9-oxo-3*H*,9*H*-benzopyrano[2,3-*d*]-1,2,3-triazole (**15**).

To a solution of 344 mg (1 mmole) of **10** in 10 ml of *N,N*-dimethylformamide was added 48 mg (1 mmole) of a 50% dispersion of sodium hydride in mineral oil. The solution was stirred at 65° for 2 hours and the solvent was removed under reduced pressure. Water was added to the residue and the yellow solid was filtered off, washed well with water and dried over phosphoric oxide in vacuum to give 300 mg (98%) of **15**. Recrystallization from ethanol gave off-white material, mp 205-206°; ir (potassium bromide): 1685, 1620, 1560, 1435 cm^{-1}; nmr (DMSO-d_6): δ 3.24 (s, OCH_3, 3H), 3.91 (s, CH_2, 2H), 7.10 (d d, H-7, 1H, $J_{5,7}$ = 2 Hz, $J_{7,8}$ = 9 Hz), 7.23 (d, H-5, 1H, J = 2 Hz), 7.38 (s, benzyl aromatics, 5H), 8.13 (d, H-8, 1H, J = 9 Hz); ms: 297 (M^+, 34), 278 (36), 91 (100), 65 (30).

Anal. Calcd. for $C_{17}H_{13}N_3O_3$: C, 66.45; H, 4.25; N, 13.65. Found: C, 66.15; H, 4.05; N, 13.75.

3-Benzyl-6-methoxy-5-methyl-9-oxo-3*H*,9*H*-benzopyrano[2,3-*d*]-1,2,3-triazole (**16**).

To a solution of 179 mg (0.5 mmole) of **11** in 8 ml of dry *N,N*-dimethylformamide was added 25 mg (0.5 mmole) of a 50% dispersion of sodium hydride in mineral oil. After stirring for 15 minutes at room temperature the mixture was heated to 50° for 2 hours during which time the product gradually precipitated. The solvent was removed under reduced pressure and the residue was triturated with water, filtered off and dried to give 152 mg (95%) of **16** as a white solid. Recrystallization from *N,N*-dimethylformamide and drying in vacuum at 90° gave material mp 305-307° dec; ir: 1665, 1615, 1270, 720 cm^{-1}; nmr (deuteriotrifluoroacetic acid): δ 2.40 (s, aromatic CH_3, 3H), 4.06 (s, OCH_3, 3H), 5.90 (s, CH_2, 2H), 7.21 (d, H-7, 1H, J = 9 Hz), 7.45 (m, benzyl aromatics, 5H), 8.32 (d, H-8, 1H, J = 9 Hz); ms: 321 (M^+, 25), 292 (38), 291 (21), 151 (15), 91 (100).

Anal. Calcd. for $C_{18}H_{15}N_3O_3$: C, 67.3; H, 4.7; N, 13.1. Found: C, 67.4; H, 4.8; N, 12.85.

1-Benzyl-7-methoxy-8-methyl-3*H*-1,4-oxothiano[2,3-*d*]-1,2,3-triazole (**17**).

To a solution of 1.18 g (3.3 mmoles) of **12** in 30 ml of dry *N,N*-dimethylformamide was added 150 mg (3.3 mmoles) of a 50% dispersion of sodium hydride in mineral oil and the mixture was stirred at 65-70° for 4 hours. The solvent was removed under reduced pressure, water was added to the residue and the solid filtered off. Recrystallization from ethanol gave 290 mg (27%) of **17** as a buff solid, mp 191-192° dec; ir: 1605, 1565, 1290 cm^{-1}; nmr (DMSO-d_6): δ 2.00 (s, aromatic CH_3, 3H), 3.76 (s, OCH_3, 3H), 5.50 (s, CH_2, 2H), 6.78 (d, H-8, 1H, J = 9 Hz), 7.07 (d, H-7, 1H, J = 9 Hz), 7.35 (s, benzyl aromatics, 5H); ms: 325 (M^+, 32), 206 (100), 91 (15).

Anal. Calcd. for $C_{17}H_{15}N_3O_2S$: C, 62.75; H, 4.65; N, 12.9. Found: C, 62.55; H, 4.25; N, 12.6.

6-Methoxy-9-oxo-1*H*,9*H*-benzopyrano[2,3-*d*]-1,2,3-triazole (**18**).

To a suspension of 500 mg of **15** in 200 ml of methanol, *N,N*-dimethylformamide (4:1) under nitrogen was added 50 mg of 5% palladium on charcoal (Engelhard 4573) and the mixture was hydrogenated at 50 psi and 100° for 2 hours. After cooling, the catalyst was filtered off and the filtrate was evaporated. Crystallization of the residue from methanol gave 124 mg (35%) of **18**, mp 267-270° dec (lit [4] mp 270-271° dec), mixed mp 267-269° dec.

6-Methoxy-5-methyl-9-oxo-1*H*,9*H*-benzopyrano[2,3-*d*]-1,2,3-triazole (**19**).

Reduction of 500 mg of **16** in 200 ml of methanol, *N,N*-dimethylformamide (4:1) as described for compound **18** afforded 150 mg (41%) of **19**, mp 267-269° dec (lit [4] mp 268-270° dec), mixed mp 268-270° dec; after chromatography on silica with chloroform and recrystallization from ethanol.

5-Chloro-1-(4-methoxybenzyl)-1*H*-1,2,3-triazole-4-carboxylic Acid (**20**).

A mixture of 3.28 g (11 mmoles) ethyl 5-chloro-1-(4-methoxybenzyl)-

1*H*-1,2,3-triazole-4-carboxylate [11] and 45 ml of 1*N* aqueous sodium hydroxide was stirred for 2 hours at 85°, the resulting solution was cooled to 0° and acidified. The precipitated solid was filtered off and dried to give 2.94 (100%) of the acid **20**, mp 139-140° dec; (from ethyl acetate-petroleum ether (bp 40-60°)); ir: 2630, 2550, 1700, 1610, 1545, 1515, 1255 cm^{-1}; nmr (DMSO-d_6): δ 3.72 (s, OCH_3, 3H), 5.58 (s, CH_2, 2H), 7.08 (ABq, aromatics, 4H, J = 9 Hz, $\Delta\nu$ = 30 Hz).

Anal. Calcd. for $C_{11}H_{10}ClN_3O_3$: C, 49.35; H, 3.75; N, 15.7. Found: C, 49.3; H, 3.75; N, 15.5.

Acylation of 1,3-Dimethoxybenzene with Compound **21**.

One drop of *N,N*-dimethylformamide was added to a mixture of 2.37 g (9 mmoles) of **20** and excess oxalyl chloride (2.0 g) in 25 ml of dry dichloromethane and the reaction was stirred for 90 minutes at room temperature. Solvent and excess oxalyl chloride were then removed under reduced pressure to give the crude acid chloride **21**; ir (film): 1760 cm^{-1} (C=O). This material was redissolved in 50 ml of dry dichloromethane, 1.25 g (9 mmoles) of 1,3-dimethoxybenzene was added and the solution was cooled to 0°. To the stirred solution was added 3.6 g (3 equivalents) of powdered anhydrous aluminium chloride in portions over 15 minutes and the total was stirred overnight at room temperature. Work up with iced 5*M* hydrochloric acid and extraction of the product into chloroform gave a yellow foam on evaporation. Chromatography on silica eluting with chloroform gave 1.33 g (58%) of 5-chloro-4-(2-hydroxy-4-methoxybenzoyl)-1*H*-1,2,3-triazole, **22**, as a yellow crystalline solid. Recrystallization from aqueous methanol gave material mp 177-178° dec; ir: 3150, 1635, 1585, 1270, 1100 cm^{-1}; nmr (DMSO-d_6): δ 3.82 (s, OCH_3, 3H), 6.52 (d, H-3, 1H, J = *ca* 2 Hz), 6.58 (d d, H-5, 1H, $J_{2,5}$ = 2 Hz, $J_{5,6}$ = 9 Hz), 8.10 (d, H-6, 1H, J = 9 Hz); ms: 253 (M^+, 100), 218 (62), 151 (65); M^+ ($C_{10}H_8ClN_3O_3$) 253.0264.

REFERENCES AND NOTES

[1] Part **10**. D. R. Buckle, C. J. M. Rockell, H. Smith and B. A. Spicer, *J. Med. Chem.*, **27**, 223 (1984).

[2] T. L. Gilchrist and G. E. Gymer, *Adv. Heterocyclic Chem.*, **16**, 42 (1974); K. T. Finley, "Triazoles 1,2,3", J. A. Montgomery, ed, Interscience-Wiley, New York, 1980, Chapter 5.

[3] D. R. Buckle, *J. Chem. Res. (S)*, 308 (1980).

[4] D. R. Buckle, D. J. Outred and C. J. M. Rockell, *J. Heterocyclic Chem.*, **18**, 1117 (1981); D. R. Buckle, D. J. Outred, C. J. M. Rockell, H. Smith and B. A. Spicer, *J. Med. Chem.*, **26**, 251 (1983).

[5] W. Borsche, H. Hahn and M. Wagner-Roemmich, *Ann. Chem.*, **554**, 15 (1943); R. Fusco, G. Bianchetti, D. Pocar and R. Ugo, *Gazz. Chim. Ital.*, **92**, 1040 (1962); J. Rody and H. Lind, German Patent 2,111,538 (1971); *Chem. Abstr.*, **76**, 114090d (1972).

[6] L. Field and P. H. Settlage, *J. Am. Chem. Soc.*, **76**, 1222 (1954).

[7] E. E. Gilbert, *J. Org. Chem.*, **28**, 1945 (1963).

[8] See for example, E. Berliner, *Org. React.*, **5**, 229 (1957).

[9] J. M. Tedder, "Reactions Between Pyrazoles and Thionyl Chloride", Ph. D. Thesis, University of London, 1977.

[10] S. Carpenter, Personal communication.

[11] D. R. Buckle and C. J. M. Rockell, *J. Chem. Soc., Perkin Trans. I*, 627 (1982).