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September 2014: The paragraphs above replace the section "Handling and Disposal of Hazardous Chemicals" in the originally published version of this article. The statements above do not supersede any specific hazard caution notes and safety instructions included in the procedure.

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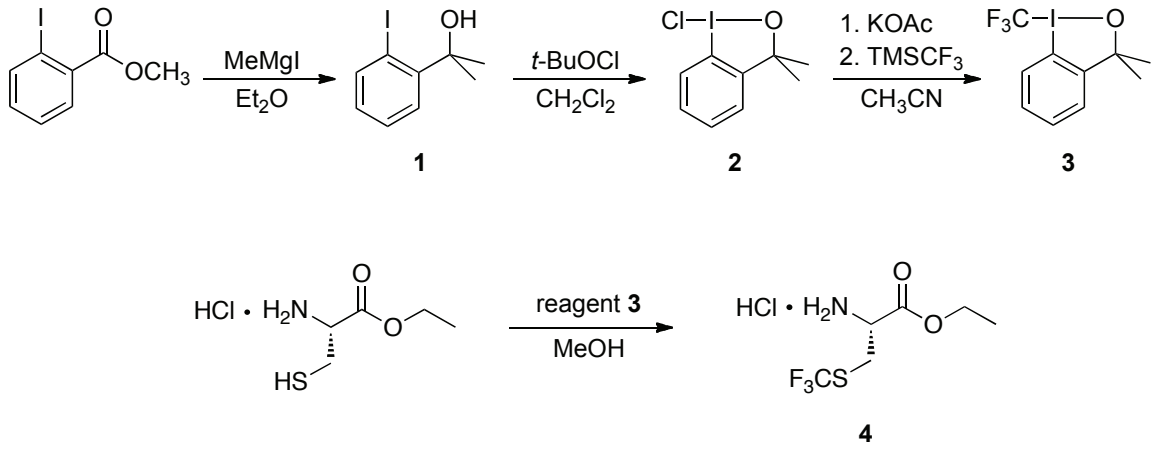
PREPARATION OF A TRIFLUOROMETHYL TRANSFER AGENT: 1-TRIFLUOROMETHYL-1,3-DIHYDRO-3,3-DIMETHYL-1,2-BENZIODOXOLE



Submitted by Patrick Eisenberger, Iris Kieltsch, Raffael Koller, Kyrill Stanek, and Antonio Togni.[1]
Checked by Kay M. Brummond and Baptiste Manteau.

1. Procedure

*Caution! During the preparation of **3**, care should be taken not to heat the reaction mixture or crude product. DSC and TGA measurements reveal a good thermal stability below the melting point (78 °C) of the product 1-trifluoromethyl-1,3-dihydro-3,3-dimethyl-1,2-benziodoxole (**3**). However, above the melting point a rapid exothermic decomposition takes place (ca. 60 kcal mol^{-1}). Added 3/20/13: For a study of the explosive properties of this compound, see Fiederling, N.; Haller, J.; Schramm, H. Org. Process Res. Dev. **2013**, 17, 318. No study has been carried out on the explosive properties of compound **2**, but this substance should also be treated with caution.*

A. 2-(2-Iodophenyl)propan-2-ol (**1**) A 250-mL three-necked, round-bottomed flask equipped with a reflux condenser, an argon inlet, a 50-mL dropping funnel with a rubber septum, a Teflon-coated magnetic stir bar and a rubber septum is charged with magnesium turnings (9.43 g, 388 mmol, 3.10 equiv) (Note 1). The vessel is flame dried under vacuum and

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maintained under an atmosphere of argon during the course of the reaction (Note 2). The flask is charged with diethyl ether (25 mL) (Note 3). The dropping funnel is charged with a solution of methyl iodide (17.3 mL, 278 mmol, 2.20 equiv) (Note 4) in diethyl ether (25 mL) by means of a syringe. The methyl iodide solution is added dropwise to the magnesium turnings. The reaction is initiated, as evidenced by reflux, upon the addition of 4 mL of methyl iodide solution. The reaction mixture is immediately diluted with additional diethyl ether (35 mL) through the septum of the flask using a syringe. Addition of methyl iodide is continued at a rate of 1 mL/min to maintain a gentle reflux. After the addition is complete the reaction mixture is allowed to cool to ambient temperature. The brownish reaction mixture is allowed to stand until the remaining magnesium turnings have settled, then the supernatant is transferred via cannula through the septa into a 500-mL three-necked, round-bottomed flask equipped with a reflux condenser with argon inlet, a 50-mL dropping funnel with a rubber septum, a large Teflon-coated magnetic stir bar and a rubber septum (Note 5). The magnesium turnings are rinsed with diethyl ether (25 mL), and the rinsings are transferred to the reaction flask by cannula, and the solution is cooled to 0 °C (ice/water bath). The dropping funnel is charged with a solution of methyl 2-iodobenzoate (19.1 mL, 126 mmol, 1.00 equiv) in diethyl ether (20 mL) by means of a syringe. The solution is added dropwise under vigorous stirring over 10 min (Note 6). Additional diethyl ether (13 mL) is used to rinse the dropping funnel. The reaction mixture is left in the cooling bath and allowed to warm to ambient temperature overnight (15 h). The brown suspension is heated to reflux for 1.5 h (Note 7), then cooled to 0 °C (ice water bath) and treated carefully with a saturated aqueous ammonium chloride solution (150 mL). A thick yellow precipitate forms and water (2 × 150 mL) is added until most of the solid material dissolves, and then the yellow suspension is filtered through a pad of celite. The organic phase is separated from the aqueous phase, and the aqueous phase is extracted with diethyl ether (4 x 200 mL). The combined ethereal phases are dried over potassium carbonate, filtered, the solvent is evaporated on a rotary evaporator (40 °C, 675 mmHg), and the residue dried under vacuum. The crude compound **1** (27.5 g, 105 mmol, 83% yield, 90% purity) is obtained as a brownish oil (Notes 8-10).

B. 1-Chloro-1,3-dihydro-3,3-dimethyl-1,2-benziodoxole (**2**) A 100-mL two-necked, round-bottomed flask is equipped with an argon inlet, a Teflon-coated magnetic stir bar and a rubber septum and is protected from light by

wrapping the flask in aluminum foil. The flask is charged with crude compound **1** (18.9 g, 64.9 mmol, 90% purity, 1.00 equiv) and purged with argon. Dichloromethane (60 mL) is added under a positive flow of argon (Note 11), and the solution is cooled to 0 °C. *tert*-Butyl hypochlorite (7.50 mL, 66.4 mmol, 1.02 equiv) is added over 20 seconds to this solution in the dark by means of a syringe (Note 12). Stirring overnight (17 h) results in a bright yellow orange solution that is concentrated using rotary evaporation (40 °C, 600 mmHg) and further dried under vacuum at room temperature for 30 min. The yellowish residue is dissolved in hot dichloromethane (50 mL) to give a bright yellow solution. Upon cooling in the freezer at -15 °C for 16 h large yellow crystals are formed and subsequently filtered (10.4 g, 35.1 mmol). The mother liquor is concentrated, dried under vacuum and treated with hot solutions of pentane (15 mL) and dichloromethane (15 mL) before being cooled in the freezer overnight (14 h) leading to the formation of another crop of yellow crystals, which are then filtered (3.50 g, 11.8 mmol). This sequence is repeated two more times to give 16.5 g of yellow crystals in total. The combined crystals are dried under vacuum to give compound **2** (16.5 g, 55.6 mmol, 86% based on 90% purity of compound **1**) as bright yellow crystals, mp = 148 – 150 °C (dec.) (Note 13).

C. 1-Trifluoromethyl-1,3-dihydro-3,3-dimethyl-1,2-benziodoxole (**3**) A 250-mL Schlenk flask equipped with a large Teflon-coated magnetic stir bar and a rubber septum is flame-dried under vacuum and maintained under an atmosphere of argon during the course of the reaction. The flask is charged with potassium acetate (6.66 g, 67.9 mmol, 1.68 equiv) and heated under vacuum using a heat gun (Note 14). After allowing the reaction flask to cool to room temperature, compound **2** (11.9 g, 40.3 mmol, 1.00 equiv) is added under a positive flow of argon followed by acetonitrile (100 mL) by means of a syringe. The yellow suspension is vigorously stirred for 1 h at ambient temperature giving a white suspension. Next, a 500-mL round-bottomed Schlenk-flask equipped with a Schlenk-frit with a rubber septum, and a Teflon-coated magnetic stir bar is flame-dried under vacuum and maintained under an atmosphere of argon. The white suspension from above is added to the Schlenk frit via cannula. The filtration is accomplished by creating a partial vacuum in the 500-mL Schlenk flask.

The 250-mL Schlenk flask is washed with additional acetonitrile (50 mL), and the acetonitrile wash is transferred to the Schlenk frit. Once all the liquid has been removed from the Schlenk-frit, it is replaced by a rubber septum under a positive flow of argon. The final solution in the 500-mL Schlenk flask is clear and almost colorless. Additional acetonitrile (50 mL) is added to the clear solution. The solution is cooled to -17 °C internal temperature (cryostat/isopropanol, -20 °C bath temperature) upon which the acetoxy intermediate starts to precipitate giving a white suspension. (Trifluoromethyl)trimethylsilane (9.60 mL, 64.9 mmol, 1.61 equiv) is added by syringe, followed by dropwise addition of a solution of tetra-*n*-butyl-ammonium difluorotriphenylsilicate (0.065 g, 0.12 mmol, 0.3 mol%) in acetonitrile (2 mL) (Note 15). The reaction mixture is stirred for 16 h at -17 °C, and then warmed to -12 °C, at which time additional (trifluoro-methyl)trimethylsilane (1.30 mL, 8.80 mmol, 0.22 equiv) is added. The clear orange brown reaction mixture is warmed to ambient temperature over 3 h and then stirred at ambient temperature for an additional 3 h (Note 16). The volatile components of the mixture are removed using rotary evaporation (40 °C, 125 mmHg) and then under vacuum (0.8 mmHg) to give a slightly orangish-brown solid (Note 17). Dry *n*-pentane (150 mL) is added to the remaining brown solid (Note 18). A 250-mL Schlenk flask equipped with a Schlenk-frit (1.5 inch diameter), a 0.7 inch pad of aluminium oxide and a rubber septum is carefully flame-dried under vacuum and then maintained under argon. After allowing the apparatus to cool to room temperature, the solution is filtered through the pad of aluminium oxide via cannula into the Schlenk flask to give a clear, colorless solution (Note 19). Once all the liquid has been transferred from the Schlenk-frit, it is replaced by a rubber septum. The Schlenk flask is placed in a cool water bath (15 °C), and the solution is concentrated to dryness under vacuum to give compound **3** (11.3 g, 34.2 mmol, 85%) as a white solid, mp = 73 – 75 °C (Notes 20 and 21).

D. Ethyl (R)-2-amino-3-(trifluoromethylthio)propanoate hydrochloride (**4**) A 50-mL Schlenk tube equipped with a Teflon-coated magnetic stir bar and a rubber septum is charged with reagent **3** (730 mg, 2.21 mmol, 1.10 equiv) (Note 22). A second, 25-mL Schlenk tube equipped with a Teflon-coated magnetic stir bar and a rubber septum is charged with ethyl (*R*)-2-amino-3-mercaptopropanoate hydrochloride (373 mg, 2.01 mmol, 1.00 equiv) (Note 23). In both Schlenk tubes, an atmosphere of argon is established using three vacuum/argon cycles (Note 24). To both Schlenk tubes, methanol (4.5 mL each) is added via syringe (Note 25). Two colorless

solutions are obtained and cooled to -78 °C (dry ice-acetone bath). The solution of the (*S*)-2-amino-3-mercaptopropanoic acid ethyl ester hydrochloride in methanol is added dropwise to the solution of reagent **3** using a cannula over 2 min. The solution turns yellow immediately. The 25-mL Schlenk tube is washed with methanol (2 x 2 mL) and the washing is also transferred to the 50-mL Schlenk tube via cannula. The solution is stirred at -78 °C for 30 min upon which it becomes colorless again. The cooling bath is replaced by a water bath (room temperature) and the solution is stirred for an additional 30 min, before it is concentrated under vacuum (Note 26). After complete removal of the solvent and further drying at room temperature under vacuum for 30 min, the oily colorless solid is washed with a mixture of hexanes and ethyl acetate (20:1; 3 x 20 mL) (Note 27). The suspension is filtered through a sintered glass filter and the Schlenk tube and the filter are washed with additional hexanes (2 x 20 mL). The remaining solid is dissolved in methanol (20 mL) and the clear colorless solution was taken to dryness using rotary evaporation (40 °C, 200 mmHg) and further dried under vacuum to give a white solid (495 mg, 1.95 mmol, 97%) with mp = 157-159 °C (Note 28).

2. Notes

1. Magnesium (purum) was purchased from Aldrich and used as received. Product **1** is obtained in higher purity when methyl magnesium iodide is freshly prepared. Performing the reaction using commercial methylmagnesium iodide results in the formation of significant quantities of 2-phenylpropan-2-ol.

2. The authors report that nitrogen can be used instead of argon.

3. Diethyl ether (puriss.) was purchased from Sigma-Aldrich and purified by passing through alumina using the Sol-Tek ST-002 solvent purification system.

4. Methyl iodide (99.5%) was purchased from Sigma-Aldrich and used as received.

5. The flask was flame-dried under vacuum prior to use.

6. Methyl 2-iodobenzoate (98%) was purchased from Alfa-Aesar and used as received.

7. The reaction can be monitored by treating an aliquot of the reaction mixture with a saturated solution of NH_4Cl and extracting it with Et_2O. The organic phase is then subjected to analytical thin layer chromatography

(TLC) using precoated glass plates (TLC Silica Gel 60 F_{254}, EMD Chemicals), eluted with 20% ethyl acetate in hexane, and visualized with UV (254 nm) (compound **1** R_f = 0.50, 1-(2-iodophenyl)ethanone R_f = 0.59, methyl 2-iodobenzoate R_f = 0.66).

8.The authors report that analytically pure compound **1** can be obtained by bulb-to-bulb distillation at 110 °C (0.01 mmHg) which gives a slightly yellow, sticky oil that solidifies in a freezer (-18 °C).

9. The submitters report that compound **1** can be prepared on a 200 g scale of product with slightly higher yields. On this larger scale it is necessary to use an overhead stirrer for the second step of the reaction and the extraction should be carried out using MTBE instead of Et_2O.

10. 2-(2-Iodophenyl)propan-2-ol can be stored under nitrogen at -18 °C without any decomposition, whereas at ambient temperature and when exposed to light it slowly decomposes. It has the following spectroscopic properties: ^{1}H NMR (300 MHz, $CDCl_3$) δ: 1.78 (s, 6 H), 2.62 (bs, 1 H), 6.91 (t, *J* = 7.8 Hz, 1 H), 7.34 (t, *J* = 7.8 Hz, 1 H), 7.65 (d, *J* = 7.8 Hz, 1 H), 7.98 (d, *J* = 7.8 Hz, 1 H); ^{13}C NMR (75 MHz, $CDCl_3$) δ: 29.8, 73.6, 93.2, 126.8, 128.2, 128.6, 142.7, 148.5; IR (neat): 3400, 3056, 2974, 2929, 1581, 1560, 1459, 1424, 1365, 1328, 1264, 1231, 1171, 1048, 1004, 952, 856, 757 cm^{-1}. The purity of the product was estimated by integrating the impurity (2-phenylpropan-2-ol) resonance at δ = 7.5 and the product resonance at δ = 7.6 in the ^{1}H NMR. From this the mol% of impurity is estimated to be 18% and the mass contribution calculated to be 10%.

11. Dichloromethane (99.5%) was purchased from Fisher Scientific and used as received.

12. *tert*-Butyl hypochlorite was purchased from TCI America and used as received. The authors synthesized *tert*-butyl hypochlorite according to *Org. Synth*. *Coll. Vol. 5*, 183. This procedure should be conducted in dim light and direct exposure to the hypochlorite should be avoided. The product should not be exposed to direct sunlight or rubber. Do not heat the product over its boiling point.

13. The authors report that the synthesis of compound **2** can be scaled up to 50 g of product without a significant drop in yield. *Caution:* The reaction is exothermic; on a larger scale it is important to have an adequate cooling bath and a reflux condenser. The reaction can be monitored by taking an aliquot of the reaction mixture and subjecting it to analytical thin layer chromatography (TLC) using precoated glass plates (TLC Silica Gel 60 F_{254}, EMD Chemicals), eluting with 20% ethyl acetate in hexane, and

visualized with UV (254 nm) (compound **1** $R_f = 0.50$, compound **2** $R_f = 0.05$ – 0.40 smearing from the baseline). 1-Chloro-1,3-dihydro-3,3-dimethyl-1,2-benziodoxole is bench stable and can be stored in air. It has the following spectroscopic properties: ^{1}H NMR (300 MHz, $CDCl_3$) δ: 1.57 (s, 6 H), 7.17–7.20 (m, 1 H), 7.52–7.61 (m, 2 H), 8.03–8.06 (m, 1 H); ^{13}C NMR (75 MHz, $CDCl_3$) δ: 29.3, 85.1, 114.6, 126.1, 128.4, 130.4, 131.0, 149.5; IR (neat): 3081, 2970, 2924, 1590, 1562, 1460, 1438, 1378, 1364, 1275, 1255, 1178, 1154, 1110, 1030, 1001, 942, 864, 760, 720 cm^{-1}. Anal. Calcd. for $C_9H_{10}ClIO$: C, 36.45; H, 3.50; I, 42.80. Found: C, 36.41; H, 3.36; I, 42.52.

14. Potassium acetate (puriss) was purchased from Sigma-Aldrich and used as received, acetonitrile (puriss) was purchased from Sigma-Aldrich and purified by distillation over CaH_2 under argon.

15. (Trifluoromethyl)trimethylsilane and tetra-*n*-butylammonium difluorotriphenylsilicate were purchased from Sigma-Aldrich, tetra-*n*-butylammonium difluorotriphenylsilicate is dried under vacuum at room temperature for 1 h prior to use.

16. At -12 °C the reaction mixture should be a clear solution, if it is a suspension it should be cooled to -17 °C and tetra-*n*-butylammonium difluorotriphenylsilicate (0.065 g, 0.120 mmol) in acetonitrile (2 mL) is added to reinitiate the reaction. Then the reaction mixture is warmed to -12 °C over 4 h. For the checkers, a clear solution was always obtained at -12 °C and additional aliquots of tetra-*n*-butylammonium difluorotriphenyl-silicate were not necessary.

17. The product sublimes very easily. To prevent its loss, the Schlenk-flask should be cooled in an ice/water bath while drying the product under vacuum.

18. Pentane was purchased from EMD Chemicals and purified by distillation from sodium benzophenone ketyl.

19. Neutral aluminum oxide, activity I, was purchased from Sigma-Aldrich and flame dried under vacuum prior to use.

20. The yields of the synthesis may vary slightly. It is imperative to control and maintain the given temperatures accurately. Temperatures refer to the reaction mixture, not the cooling bath. The reaction can be monitored by taking an aliquot of the reaction mixture and subjecting it to analytical thin layer chromatography (TLC) using precoated glass plates (TLC Silica Gel 60 F_{254}, EMD Chemicals), eluted with 50% ethyl acetate in hexanes and visualized with UV (254 nm) (compound **2** $R_f = 0.05 – 0.48$ smearing from the baseline, 1-acetoxy-1,3-dihydro-3,3-dimethyl-1,2-benziodoxole R_f =

0.05 – 0.43 smearing from the baseline, compound **3** R_f = 0.65). 1-Trifluoromethyl-1,3-dihydro-3,3-dimethyl-1,2-benziodoxole is moisture sensitive and should be stored under nitrogen or argon at –18 °C. Under these conditions the authors did not observe any decomposition over prolonged periods of time. DSC and TGA measurements reveal a good thermal stability below the melting point of the substance (78 °C). However, above the melting point a rapid exothermic decomposition takes place (ca. 60 kcal mol^{-1}). High-purity samples of **3** may be obtained by sublimation at 40 °C (0.02 mmHg) during 4 h. Compound **3** is suspected to be toxic and should be handled with appropriate protection.

21. Trifluoromethyl-1,3-dihydro-3,3-dimethyl-1,2-benziodoxole has the following spectroscopic properties: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 1.50 (s, 6 H), 7.40–7.45 (m, 2 H), 7.53–7.56 (m, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$) *δ*: 30.8, 76.5, 110.6 (q, *J* = 3.0 Hz), 110.7 (q, *J* = 396.1 Hz), 127.3, 127.8 (q, *J* = 2.7 Hz), 129.8, 130.6, 149.2; ^{19}F NMR (376.6 MHz, $CDCl_3$) δ: –40.1; IR (neat): 2969, 2925, 1565, 1461, 1439, 1374, 1357, 1273, 1248, 1164, 1087, 999, 959, 871, 748 cm^{-1}; HRMS (MS ES+) calcd for $C_{10}H_{11}F_3IO$: 330.9807 (M + H). Found: 330.9793 (M + H). Anal. Calcd. for $C_{10}H_{10}F_3IO$: C, 36.39; H, 3.05; F, 17.27; I, 38.45. Found: C, 36.46; H, 3.04; F, 17.46; I, 38.29.

22. A Schlenk tube was chosen for the sake of convenience, a two-necked, round-bottomed flask with an argon inlet can be used instead.

23. Ethyl (*R*)-2-amino-3-mercaptopropanoate hydrochloride (98%) was purchased from Sigma Aldrich and used as received.

24. Nitrogen can also be used.

25. Methanol (anhydrous) was purchased from Sigma-Aldrich and used as received.

26. A rotary evaporator can be used instead.

27. *n*-Hexanes (96 %) and ethyl acetate (puriss) were purchased from Fisher Scientific and both were used as received. This step removes trace quantities of 2-(2-iodophenyl)propan-2-ol, and the checkers found that it was necessary to do additional washings to remove this compound.

28. Ethyl (*R*)-2-amino-3-(trifluoromethylthio)propanoate hydrochloride is stable to air and has the following spectroscopic properties ^{1}H NMR (400 MHz, MeOH-*d4*) δ: 1.36 (t, *J* = 7.1 Hz, 3 H), 3.62 (dd, *J* = 6.1, 15.2 Hz, 1 H), 3.68 (dd, *J* = 5.7, 15.2 Hz, 1 H), 4.35 (q, *J* = 7.1 Hz, 2 H), 4.48 (t, *J* = 5.8 Hz, 1 H), 5.19 (bs, 3 H); ^{13}C NMR (100 MHz, MeOH-*d4*) δ: 13.0, 28.9, 52.3, 63.0, 130.4 (q, *J* = 306.0 Hz), 166.7. ^{19}F NMR (376.6 MHz, MeOH-*d4*) δ: –42.9; IR (KBr pellet): 2923, 1740, 1598, 1571, 1487, 1390,

1352, 1424, 1118, 1013, 982, 855, 758, 740 cm^{-1}; HRMS (MS ES+) calcd for $C_6H_{11}NO_2F_3S$: 218.0463 (M + H). Found: 218.0450 (M + H); Anal. Calcd. for $C_6H_{11}NO_2F_3SCl$: C, 28.41; H, 4.37; F, 5.52; F, 22.47. Found: C, 28.52; H, 4.26; N, 5.55; F, 22.34.

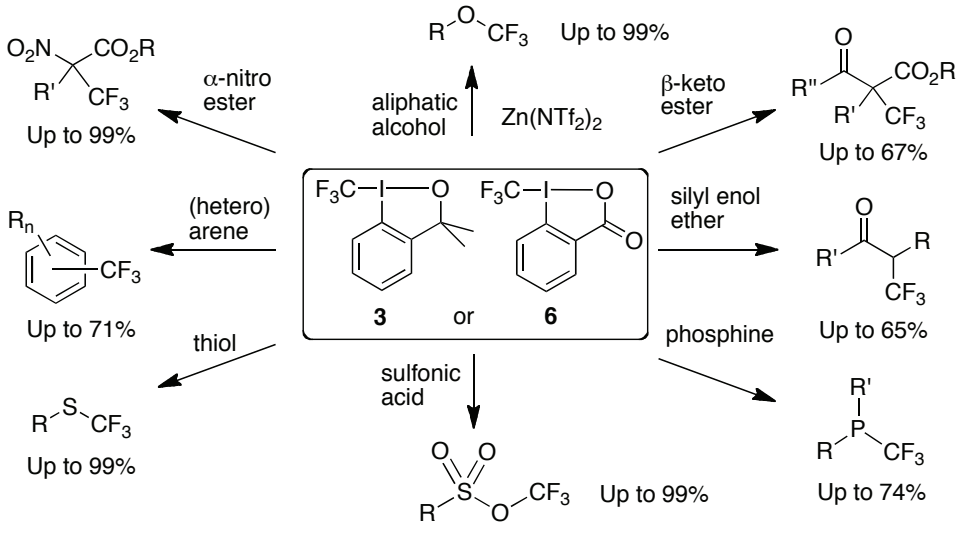
Safety and Waste Disposal Information

All hazardous materials should be handled and disposed of in accordance with "Prudent Practices in the Laboratory"; National Academy Press; Washington, DC, 1995.

3. Discussion

Compounds **3** and **6** represent a new generation of electrophilic trifluoromethylation reagents, originally reported by Togni and co-workers in 2006.[2] The preparation of these compounds is conveniently carried out on a multi-gram-scale from easily available starting materials. Both reagents offer the advantage of being potentially recyclable. In fact, the byproducts resulting from a trifluoromethylation reaction either with reagent **3** or **6** are alcohol **1** or 2-iodobenzoic acid, respectively, which are the starting materials for the preparation of the reagents. Thus, compound **1** and 2-iodobenzoic acid may be readily separated from the main products by column chromatography.

Scheme 1. Possible transformations of various substrates using reagents **3** and **6**.



Reagents **3** and **6** are suited for the trifluoromethylation of a variety of carbon-,[3] sulfur-,[3,4] phosphorus-,[5] and oxygen-centered nucleophiles (see summary in Scheme 1).[6-8] Carbon nucleophiles such as β-keto esters or silylenol ethers do afford the corresponding α-trifluoromethyl carbonyl derivatives in yields up to 60-70%, but the reaction is somewhat sluggish. α-Nitro esters give better yields but require the presence of a Cu(I) salt as a catalyst, typically 15 mol% $CuBr{\cdot}SMe_2$. Electron-rich arenes and heterocycles react in terms of an electrophilic aromatic substitution. For nitrogen-containing heterocyclic compounds, a pronounced regioselectivity is observed in favor of the position adjacent to the nitrogen atom.

Among heteroatom nucleophiles, thiols are the best substrates, cleanly reacting preferentially with reagent **3** to the corresponding trifluoromethyl thioethers in excellent yields (up to quantitative).[3] This particular reaction shows an exceptional functional-group tolerance.[4] Primary phosphines react stepwise with reagent **6** to give the products of mono- or bis(trifluoromethylation), whereby the second step requires the presence of a base, typically DBU.[5]

Phenols (or phenolates) only undergo *O*-trifluoromethylation in low yields (up to 15%) when both the ortho and para positions already bear a substituent. However, also in this case, the major products are quinoid derivatives containing the CF_3 group at a quaternary center.[6]

Finally, when reagent **6** is activated by $Zn(NTf_2)_2$ primary and secondary aliphatic alcohols are converted to the corresponding trifluoromethyl ethers. However, this reaction requires an excess of the alcohols to ensure quantitative conversions of the reagent and to avoid decomposition side reactions. Simple alcohols that are liquid at room temperature may be used as solvents for this transformation.[7]

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Appendix
Chemical Abstracts Nomenclature; (Registry Number)

2-(2-Iodophenyl)propan-2-ol (69352-05-2)
1-Chloro-1,3-dihydro-3,3-dimethyl-1,2-benziodoxole (69352-04-1)
1-Trifluoromethyl-1,3-dihydro-3,3-dimethyl-1,2-benziodoxole (887144-97-0)
Iodomethane (74-88-4)
Methyl 2-iodobenzoate (610-97-9)
Tert-butyl hypochlorite (507-40-4)
(Trifluoromethyl)trimethylsilane (81290-20-2)
Tetrabutylammonium difluorotriphenylsilicate(IV) (163931-61-1)
2-Iodobenzoic acid (88-67-5)
Sodium (meta)periodate (7790-28-5)
1-Hydroxy-1,2-benziodoxol-3-(1*H*)-one (131-62-4)
Acetic anhydride (108-24-7)
1-Acetoxy-1,2-benziodoxol-3-(1*H*)-one (1829-26-1)
Cesium fluoride (13400-13-0)
1-(Trifluoromethyl)-1,2-benziodoxol-3(1*H*)-one (887144-94-7)
Ethyl (*R*)-2-amino-3-mercaptopropanoate hydrochloride (868-59-7)

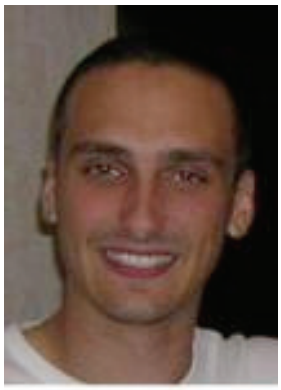
Antonio Togni was born in Switzerland in 1956. He did his undergraduate and graduate studies (with L. M. Venanzi) at the ETH Zurich from 1975 to 1983. After a postdoctoral stay at Caltech with John E. Bercaw he joined in 1985 the Central Research Laboratories of Ciba-Geigy Ltd. in Basel, Switzerland, where he started working in the field of enantioselective catalysis. In 1992 he moved back to ETH becoming a full professor of organometallic chemistry in 1999. His research interests include asymmetric catalysis and organofluorine chemistry.

Patrick Eisenberger was born in Wettingen (Switzerland) in 1978. He studied chemistry at ETH, Zurich and obtained his Diploma degree in 2003. He then joined the group of Prof. Antonio Togni working on the synthesis and application of hypervalent iodine-based trifluoromethylating reagents and received his Ph.D. in 2007. In 2008 he accepted a postdoctoral position in the group of Prof. Laurel L. Schafer at UBC, Vancouver (Canada) where he was working on early transition-metal catalyzed syntheses of small N-containing molecules by hydroamination and hydroaminoalkylation. He is currently a postdoctoral researcher with Prof. Cathleen M. Crudden at Queen's University, Kingston (Canada).

Iris Kieltsch was born in Agnetheln (Romania) in 1979. She obtained her diploma in 2004 from the University of Marburg, Germany, and her Ph.D. in 2008 under the supervision of Prof. Antonio Togni at the ETH Zurich. After completing her doctoral work she moved to the University of Hawaii for postdoctoral studies with Prof. David Vicic.

Raffael Koller was born in Baden (Switzerland) in 1982. He studied chemistry at ETH, Zurich and completed his masters thesis in the research group of Prof. Sue Gibson at Imperial College, London. In 2006 he obtained his Masters degree at ETH Zurich, and then joined the group of Prof. Antonio Togni working on the application of hypervalent iodine reagents for the trifluoromethylation of oxygen-, carbon-, and phosphorus-centered nucleophiles. In 2010, after completing his Ph.D., he moved to Stanford University for postdoctoral studies with Prof. Barry M. Trost to work on total synthesis of natural products.

Kyrill Stanek was born in Weiningen (Switzerland) in 1980. He studied chemistry at ETH Zurich and completed his masters thesis in the research group of Prof. Peter H. Seeberger in 2005. In 2006 he joined the group of Prof. Antonio Togni working on the synthesis and application of electrophilic trifluoromethylating agents to improve the trifluoromethylation of oxygen centered nucleophiles. In addition, he investigated remote fluorine-metal interactions in late transition-metal complexes. He is currently working for Bachem AG.



Baptiste Manteau was born in 1982 in Poitiers, France. In 2006, he obtained his engineering degree in chemistry from ESCOM in Paris. In 2009, he completed his Ph.D. in chemistry with Dr F. Leroux from the University of Strasbourg and in collaboration with Bayer CropScience. He worked on the development of a general method to access trifluoromethoxy-heterocyclic building-blocks. He is currently pursuing post doctoral studies at the University of Pittsburgh under the guidance of Prof. Kay Brummond. His research is currently focusing on SAR and protein binding studies of a synthetic Chk1-phosphorylation inhibitor, which has been recently discovered from a diversity oriented synthesis library founded in his current laboratory.