Synthesis of α -Trifluoromethylated Nitrogen Heterocycles.

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Chevreul. 43 Bd du 11 Novembre 1918. 69622 Villeurbanne (France).

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General. Solvents were distilled prior to use. Other reagents were used as received.

^1H , ^{13}C and ^{19}F NMR spectra were recorded in CDCl_3 at 300, 75 and 282 MHz, respectively.

Chemical shifts are given in ppm relative to TMS (^1H , ^{13}C) or CFCl_3 (^{19}F) as internal references. Coupling constants are given in Hertz.

Flash chromatography was performed on silica gel 60M (0.04-0.063 mm). Melting points (uncorrected) were determined in capillary tubes on a Büchi apparatus.

Compound **1** and **2** was prepared according to our previous work.¹⁰

1,1,1-trifluoro-4-penten-2-amine hydrochloride (**3**) :

85 mL of a 2N aqueous solution of HCl was dropped, at 0°C, in a solution of **2** (6.83 g; 22.5mmol) in CH_2Cl_2 (30 mL). At the end of the addition, the mixture was stirred at 50°C for 24h. After cooling, the crude mixture was partitioned between ether and water. Then, aqueous phase was evaporated to provide white solid (3.9g).

Mp : 210°C (degradation). ^1H NMR (D_2O) : δ = 5.64 (ddt, 1H, J = 16.7, J = 8.4, J = 8.0), 5.15 - 5.24 (massif, 2H), 4.64 (broad s, 3H), 4.04 (ddq, 1H, J = 9.0, J = 5.0, J = 7.0), 2.58 – 2.68 (massif, 1H), 2.35 – 2.47 (massif, 1H). ^{13}C NMR (D_2O) : δ = 129.6, 123.9 (q, J = 280.5), 122.4, 51.9 (q, J = 31.3), 30.9 (q, J = 1.8). ^{19}F NMR (D_2O) : δ = -74.41 (d, J = 7.0).

Benzyl *N*-[1-(trifluoromethyl)-3-butenyl] carbamate (**4**) :

To a solution of **3** (3.75 g ; 21.4 mmol) in 90 mL of water were added NaHCO_3 (4.49g ; 53.4 mmol) and benzyl chloroformate (3.8 mL ; 25.6 mmol). After stirring overnight, organic phase was washed with brine, dried over MgSO_4 and evaporated in vacuo. A white solid was obtained after recrystallisation in pentane / CH_2Cl_2 .

(2 rotamers 90/10). Mp : 77-78°C. ^1H NMR : δ = 7.36 – 7.39 (massif, 5H), 5.76 (ddt, 1H, J = 17.1, J = 9.7, J = 7.3), 5.15 - 5.24 (massif, 2H), 5.16 (s, 2H), 4.94 (d, 1H, J = 8.3), 4.42 (broad m, 1H), 2.55 – 2.60 (massif, 1H), 2.27 – 2.38 (massif, 1H). ^{13}C NMR : δ = 156.5, 136.4, 131.8, 129.0, 128.7, 128.5, 125.5 (q, J = 281.4), 119.9, 67.8, 52.7 (q, J = 30.4), 33.2 (q, J = 1.7). ^{19}F NMR : δ = -76.48 (d, J = 6.9), -76.80 (broad s). $\text{C}_{13}\text{H}_{14}\text{F}_3\text{NO}_2$: calcd : C(57.14), H(5.16), N (5.13). Found : C (57.38), H (5.30), N (5.48).

Benzyl *N*-allyl-*N*-[1-(trifluoromethyl)-3-butenyl] carbamate (**5a**) :

To a solution of **4** (273 mg ; 1 mmol) in dry DMF (1 mL), cooled to 0°C, was added NaH (60% in mineral oil ; 48 mg ; 1.2 mmol). After 10 min, allyl bromide (1.2 mL) was added. The mixture was stirred at rt for 5h and then hydrolysis with H_2O (1 mL). The crude mixture was extracted with pentane and brine. The organic phase was dried over MgSO_4 and evaporated in vacuo. The crude product was purified by chromatography over silica gel.

Colorless oil (2 rotamers). ^1H NMR : δ = 7.34 – 7.40 (massif, 5H), 5.60 – 5.95 (massif, 2H), 5.08 – 5.30 (massif, 4H), 5.21(s, 2H), 5.00(broad q, 1H, J = 8.0), 3.90 (broad m, 2H), 2.57 (broad m, 2H). ^{13}C NMR : δ = 157.4, 156.1, 136.5, 134.6, 134.2, 132.4, 132.2, 129.0, 128.9, 128.6, 128.5, 128.4, 128.2, 125.6 (q, J = 283.7), 125.4 (q, J = 283.3), 119.3, 119.5, 117.5, 117.3, 68.30, 68.35, 56.7 (q, J = 30.6), 46.3, 30.4, 30.5. ^{19}F NMR : δ = -72.84 (d, J = 8.0). $\text{C}_{16}\text{H}_{18}\text{F}_3\text{NO}_2$: calcd : C (61.33), H (5.79), N (4.47). Found : C (61.51), H (5.75), N (4.18).

Benzyl *N*-(4-pentenyl)-*N*-[1-(trifluoromethyl)-3-butenyl] carbamate (**5c**) :

Same process than **5a**.

Colorless oil (2 rotamers). ^1H NMR : δ = 7.28 – 7.40 (massif, 5H), 5.60 – 5.95 (massif, 2H), 4.60 – 5.30 (massif, 7H), 3.20 (m, 2H), 2.55 (m, 2H), 2.05 (m, 2H), 1.76 (m, 2H). ^{13}C NMR : δ = 157.5, 156.1, 138.1, 137.9, 136.7, 132.4, 132.2, 128.9, 128.5, 128.3, 128.2, 125.7 (q, J =

283.4), 125.5 (q, $J = 283.8$), 119.4, 119.2, 115.6, 115.5, 68.2, 68.1, 56.7 (broad q, $J = 30.2$), 43.4, 31.6, 30.46, 30.38, 28.55, 28.51. ^{19}F NMR : $\delta = -73.01$ (d, $J = 6.9$), -73.15 (broad s). $\text{C}_{18}\text{H}_{22}\text{F}_3\text{NO}_2$: calcd : C (63.33), H (6.50), N (4.10). Found : C (62.95), H (6.61), N (4.17).

Benzyl *N*-(5-hexenyl)-*N*-[1-(trifluoromethyl)-3-butenyl] carbamate (**5d**) :

Same process than **5a**.

Colorless oil (2 rotamers). ^1H NMR : $\delta = 7.28 - 7.42$ (massif, 5H), $5.58 - 5.91$ (massif, 2H), $4.65 - 5.30$ (massif, 7H), 3.20 (m, 2H), 2.55 (m, 2H), 2.08 (m, 2H), 1.65 (m, 2H), 1.38 (m, 2H). ^{13}C NMR : $\delta = 157.6$, 156.1, 138.9, 138.7, 136.7, 132.4, 132.2, 128.9, 128.5, 128.3, 128.2, 125.7 (q, $J = 283.7$), 125.5 (q, $J = 284.3$), 119.4, 119.1, 115.1, 115.0, 68.2, 68.0, 56.6 (broad q), 43.8, 33.7, 33.6, 30.5, 30.4, 29.0, 28.1, 26.77, 26.71. ^{19}F NMR : $\delta = -73.05$ (broad s), -73.16 (broad s). $\text{C}_{19}\text{H}_{24}\text{F}_3\text{NO}_2$: calcd : C (64.21), H (6.81), N (3.94). Found : C (64.38), H (6.66), N (3.72).

Benzyl *N*-(7-octenyl)-*N*-[1-(trifluoromethyl)-3-butenyl] carbamate (**5e**) :

Same process than **5a**.

Colorless oil (2 rotamers). ^1H NMR : $\delta = 7.30 - 7.38$ (massif, 5H), $5.58 - 5.93$ (massif, 2H), $4.60 - 5.28$ (massif, 7H), $3.05 - 3.31$ (massif, 2H), 2.56 (m, 2H), 2.04 (m, 2H), 1.63 (m, 2H), $1.28 - 1.48$ (massif, 6H). ^{13}C NMR : $\delta = 157.6$, 156.1, 139.4, 139.3, 136.7, 132.4, 132.3, 128.9, 128.53, 128.50, 128.3, 128.2, 125.7 (q, $J = 283.2$), 125.5 (q, $J = 283.4$), 119.3, 119.1, 114.71, 114.67, 68.1, 68.0, 56.5 (broad m), 43.97 (broad m), 34.08, 34.05, 30.5, 30.4, 29.5, 29.2, 29.1, 29.0, 28.5, 27.34, 27.30. ^{19}F NMR : $\delta = -72.99$ (d, $J = 6.9$), -73.12 (broad s). $\text{C}_{21}\text{H}_{28}\text{F}_3\text{NO}_2$: calcd : C (65.78), H (7.36), N (3.65). Found : C (65.65), H (7.47), N (3.58).

N-(benzyloxycarbonyl)-6-(trifluoromethyl)-1,2,5,6-tetrahydropyridine (**8a**) :

To a solution of **5a** (313 mg ; 1 mmol) in CH₂Cl₂ (10 mL) was added **6** (8 mg ; 0,01 mmol). The reaction was stirred at rt for 5h. The solvent was evaporated and the crude mixture purified by chromatography over silica gel.

Yellow oil (2 rotamers 60/40). ¹H NMR : δ = 7.35 – 7.42 (massif, 5H), 5.65 – 5.80 (massif, 2H), 5.17 – 5.29 (m, 2H), 5.08 (qd, 0.6H, *J* = 8.4, *J* = 8.38), 4.91 (qd, 0.4H, *J* = 8.4, *J* = 8.38), 4.36 (m, 1H), 3.75 (m, 1H), 2.30 – 2.70 (massif, 2H). ¹³C NMR : δ = 156.4, 155.5, 136.52, 136.46, 123.0, 128.7, 128.4, 126.2 (q, *J* = 285.6), 126.0 (q, *J* = 285.6), 123.5, 123.1, 121.2, 120.7, 68.34, 68.31, 49.9 (q, *J* = 30.5), 49.2 (q, *J* = 30.5), 41.6, 23.1, 22.9. ¹⁹F NMR : δ = -73.95 (d, 0.6F, *J* = 8.0), -74.07 (d, 0.4F, *J* = 9.2). C₁₄H₁₄F₃NO₂ : calcd : C (58.95), H (4.95), N (4.91). Found : C (59.02), H (5.09), N (4.82).

N-(benzyloxycarbonyl)-8-(trifluoromethyl)-1,2,3,4,7,8-hexahydroazocine (**8c**) :

Same process than **8a**.

Colorless oil (2 rotamers 60/40). ¹H NMR : δ = 7.29 – 7.43 (massif, 5H), 5.97 (m, 1H), 5.63 (m, 1H), 5.18 (m, 2H), 4.84 (qdd, 0.6H, *J* = 8.2, *J* = 12.3, *J* = 4.1), 4.63 (qdd, 0.4H, *J* = 8.1, *J* = 11.9, *J* = 4.0), 3.91 (m, 1H), 3.12 (m, 1H), 2.60 (m, 1H), 2.39 (m, 1H), 2.17 (m, 2H), 1.75 (m, 2H). ¹³C NMR : δ = 157.5, 156.1, 136.8, 136.7, 135.7, 135.0, 128.9, 128.9, 128.5, 128.4, 128.1, 128.0, 126.0 (q, *J* = 284.3), 125.8 (q, *J* = 284.5), 125.2, 124.8, 68.1, 67.9, 57.3 (q, *J* = 29.1), 56.9 (q, *J* = 29.3), 45.7, 45.0, 29.5, 28.3, 26.5, 26.3, 24.8, 24.4. ¹⁹F NMR : δ = -73.50 (d, 0.6F, *J* = 6.9), -73.70 (d, 0.4F, *J* = 8.0). C₁₆H₁₈F₃NO₂ : calcd : C (61.33), H (5.79), N (4.47). Found : C (61.45), H (6.04), N (4.79).

2-(trifluoromethyl)piperidine hydrochloride (**9**) :

To a solution of **8a** (285 mg ; 1 mmol) in 11 mL of EtOH, Pd/C (10% mol ; 0.11 g) was added. Then H₂ was bubbled and the reaction was kept under H₂ Pressure (1 atm) for 24h. After filtration over celite, 2 mL of HCl (12 N) were dropped at 0°C and the mixture was stirred for 6h at rt. After extraction with Et₂O and H₂O, aqueous phase was evaporated.

White solid. Mp = 220°C (degradation) ¹H NMR (D₂O) : δ = 4,02 (m, 1H) ; 3,50 (m, 1H) ; 3,07 (m, 1H) ; 2,15 (m, 1H) ; 1,8 - 2,0 (massif, 2H) ; 1,45 – 1,80 (massif, 3H). ¹³C NMR (D₂O) : δ = 123,5 (q, *J* = 280,5) ; 56,8 (q, *J* = 32) ; 45,7 ; 21,9 (q, *J* = 1,9) ; 21,6 ; 20,6. ¹⁹F NMR (D₂O) : δ = -75,84 (d, *J* = 5,7). C₆H₁₁ClF₃N : calcd : C (38.01), H (5.85), Cl (18.70), N (7.39). Found : C (37.72), H (6.07), Cl (18.52), N (7.27).

Benzyl *N*-(2-propynyl)-*N*-[1-(trifluoromethyl)-3-butenyl] carbamate (**10a**) :

Same process than **5a**.

Yellow oil (2 rotamers 60/40). ¹H NMR : δ = 7.30 – 7.50 (massif, 5H), 5.78 (m, 1H), 5.10 – 5.30 (massif, 4H), 4.97 (qt, 0.6H, *J* = 8.0, *J* = 7.7), 4.73 (broad m, 0.4H), 3.98 – 4.22 (massif, 2H), 2.61 (m, 2H), 2.56 (m, 1H). ¹³C NMR : δ = 156.5, 155.7, 136.4, 136.2, 132.15, 132.10, 129.0, 128.9, 128.7, 128.0, 128.51, 128.46, 125.4 (q, *J* = 284.1), 125.2 (q, *J* = 283.2), 119.5, 119.4, 79.7, 79.4, 72.0, 68.7, 68.6, 57.3 (q, *J* = 29.8), 56.6 (q, *J* = 29.6), 33.6, 33.2, 30.5, 30.3. ¹⁹F NMR : δ = -72.95 (d, *J* = 8.0). C₁₆H₁₆F₃NO₂ : calcd : C (61.73), H (5.18), N (4.50). Found : C (61.79), H (5.37), N (4.31).

Benzyl *N*-(2-butyrynyl)-*N*-[1-(trifluoromethyl)-3-butenyl] carbamate (**10b**) :

Same process than **5a**.

Yellow oil (2 rotamers 60/40). ¹H NMR : δ = 7.28 – 7.46 (massif, 5H), 5.80 (m, 1H), 5.05 – 5.30 (massif, 4H), 4.93 (broad m, 0.6H), 4.72 (broad s, 0.4H), 4.06 (m, 2H), 2.61 (m, 2H),

1.79 (broad m, 3H). ^{13}C NMR : δ = 156.7, 155.8, 136.7, 136.3, 132.5, 128.9, 128.8, 128.6, 127.4, 128.43, 128.36, 125.5 (q, J = 283.5), 125.3 (q, J = 285.6), 119.2, 119.0, 79.7, 79.6, 75.2, 74.8, 68.5, 68.3, 57.4 (broad q, J = 29.5), 56.8 (q, J = 29.7), 33.6, 30.5, 30.3, 3.9, 3.7. ^{19}F NMR : δ = -72.83 (broad s), -72.89 (d, J = 8.0). $\text{C}_{17}\text{H}_{18}\text{F}_3\text{NO}_2$: calcd : C (62.76), H (5.58), N (4.31). Found : C (62.88), H (5.65), N (4.26).

Benzyl *N*-(4-pentynyl)-*N*-[1-(trifluoromethyl)-3-butenyl] carbamate (**10c**) :

Same process than **5a** but 1 eq. of tetrabutylammonium iodide was added before chloropentyne.

Yellow oil (2 rotamers). ^1H NMR : δ = 7.30 – 7.42 (massif, 5H), 5.69 (m, 1H), 4.65 – 5.30 (massif, 5H), 3.31 (m, 2H), 2.58 (m, 2H), 2.18 (m, 2H), 1.78 – 2.05 (massif, 3H). ^{13}C NMR : δ = 157.5, 156.2, 136.6, 132.3, 132.2, 128.9, 128.6, 128.5, 128.3, 128.2, 125.7 (q, J = 283.2), 125.4 (q, J = 283.2), 119.5, 119.3, 83.6, 83.3, 68.3, 68.2, 56.7 (broad q, J = 30.2), 43.0, 30.3, 28.0, 16.5. ^{19}F NMR : δ = -73.01 (d, J = 8), δ = -73.18 (broad s). $\text{C}_{18}\text{H}_{20}\text{F}_3\text{NO}_2$: calcd : C (63.71), H (5.94), N (4.13). Found : C (63.95), H (6.06), N (4.01).

N-(benzyloxycarbonyl)-2-(trifluoromethyl)-5-vinyl-1,2,3,6-tetrahydropyridine (**11a**) :

To a solution of **10a** (311 mg ; 1 mmol) in CH_2Cl_2 (10 mL) was added **6** (41 mg ; 0,05 mmol). The reaction was stirred at 50°C for 24h. The solvent was evaporated and the crude mixture purified by chromatography over silica gel.

Colorless oil (2 rotamers 50/50). ^1H NMR : δ = 7.35 – 7.45 (massif, 5H), 6.32 (m, 1H), 5.78 (broad m, 1H), 4.82 – 5.30 (massif, 5H), 4.57 (m, 1H), 3.84 (m, 1H), 2.42 – 2.75 (massif, 2H). ^{13}C NMR : δ = 156.5, 155.6, 140.5, 140.4, 136.6, 136.5, 136.4, 136.3, 129.0, 128.9, 128.60, 128.56, 125.75 (q, J = 285.3), 125.80 (q, J = 285.3), 68.4, 49.1 (q, J = 31.2), 49.8 (q, J = 31.2),

40.9, 23.1. ^{19}F NMR : $\delta = 73.99$ (d, 0.5F, $J = 9.17$), -74.13 (d, 0.5F, $J = 8.5$). $\text{C}_{16}\text{H}_{16}\text{F}_3\text{NO}_2$: calcd : C (61.73), H (5.18), N (4.50). Found : C (61.62), H (4.93), N (4.23).

N-(benzyloxycarbonyl)-5-isopropenyl-2-(trifluoromethyl)-1,2,3,6-tetrahydropyridine (**11b**) :

Same process than **11a**.

Colorless oil (2 rotamers 50/50). ^1H NMR : $\delta = 7.30 - 7.42$ (massif, 5H), 5.88 (broad m, 1H), 5.25 (m, 2H), 4.85 – 5.19 (massif, 3H), 4.65 (m, 1H), 3.89 (m, 1H), 2.43 – 2.80 (massif, 2H), 1.94 (broad s, 3H). ^{13}C NMR : $\delta = 156.4, 155.6, 140.7, 140.4, 136.6, 136.5, 133.6, 133.2, 129.0, 128.7, 128.5, 128.4, 125.9$ (q, $J = 286.2$), 126.0 (q, $J = 286.2$), $68.4, 49.5$ (q, $J = 30.5$), 48.9 (q, $J = 30.5$), $41.7, 23.8, 23.4, 20.9, 20.8$. ^{19}F NMR : $\delta = -73.93$ (d, 0.5F, $J = 9.18$), -74.07 (d, 0.5F, $J = 9.18$). $\text{C}_{17}\text{H}_{18}\text{F}_3\text{NO}_2$: calcd : C (62.76), H (5.58), N (4.31). Found : C (62.73), H (5.75), N (4.39).

N-[1-(trifluoromethyl)-3-butenyl]acrylamide (**12a**) :

To a solution of **3** (878 mg ; 1 mmol) in 30 mL of CH_2Cl_2 (30 mL), cooled at 0°C , Et_3N (1.4 mL ; 10 mmol) was dropped. At the end of addition, Acryloyl chloride (543 mg ; 6 mmol) was added, followed by DMAP (65 mg ; 0.5 mmol). The reaction was then stirred at rt for 24h. The mixture was extracted with Et_2O and H_2O , dried over MgSO_4 . The solvent was evaporated.

Yellow solid. Mp = $75-77^\circ\text{C}$. ^1H NMR : $\delta = 6.27$ (dd, 1H, $J = 16.95, J = 1.51$), 6.08 (dd, 1H, $J = 16.95, J = 10.17$), 5.99 (broad d, 1H, $J = 8.29$), $5.59 - 5.74$ (massif, 2H), $5.07 - 5.13$ (massif, 2H), 4.72 (m, 1H), 2.52 (m, 1H), 2.30 (m, 1H). ^{13}C NMR : $\delta = 166.6, 131.9, 130.3, 128.3, 125.4$ (q, $J = 281.7$), $119.5, 50.4$ (q, $J = 30.4$), 32.8 . ^{19}F NMR : $\delta = -75.97$ (d, $J = 8.03$). $\text{C}_8\text{H}_{10}\text{F}_3\text{NO}$: calcd : C (49.74), H (5.22), N (7.25). Found : C (49.99), H (5.03), N (7.09).

N-[1-(trifluoromethyl)-3-butenyl]-10-undecenamidene (**12b**) :

Same process than **12a**.

Yellow oil. ^1H NMR : δ = 6.37 (d, 1H, J = 9.6), 5.65-5.86 (massif, 2H), 5.15 (m, 2H), 4.93 (m, 2H), 4.68 (m, 1H), 2.51 (m, 1H), 2.20-2.36 (massif, 3H), 2.02 (m, 2H), 1.61 (m, 2H), 1.27-1.36 (massif, 10H). ^{13}C NMR : δ = 174.1, 139.4, 132.0, 125.4 (q, J = 281.8), 119.5, 114.5, 49.9 (q, J = 30.2), 36.7, 34.1, 33.0 (q, J = 1.8), 29.7, 29.6, 29.5, 29.4, 29.3, 26.0. ^{19}F NMR : δ = -76.10 (d, J = 8.03). $\text{C}_{16}\text{H}_{26}\text{F}_3\text{NO}$: calcd : C (62.93), H (8.58), N (4.59). Found : C (62.82), H (8.65), N (4.47).

6-(trifluoromethyl)-5,6-dihydro-2(1H)-pyridinone (**13a**) :

To a solution of **12a** (193 mg ; 1 mmol) in CH_2Cl_2 (10 mL) was added **7** (43 mg ; 0,05 mmol). The reaction was stirred at 50°C for 24h. The solvent was evaporated and the crude mixture purified by chromatography over silica gel.

Colorless oil. ^1H NMR : δ = 6.58 (m, 1H), 5.96 (d, 1H, J = 10.2), 4.09 (m, 1H), 2.68 (m, 2H), 1.93 (broad s, 1H). ^{19}F NMR : δ = -78.49 (d, J = 6.9). $\text{C}_6\text{H}_6\text{F}_3\text{NO}$: calcd : C (43.65), H (3.66), N (8.48). Found : C (43.53), H (3.93), N (8.31).

14-(trifluoromethyl)aza-11-cyclotetradecen-2-one (**13b**) :

To a solution of **12b** (67 mg ; 0.22 mmol) in CH_2Cl_2 (180 mL) was added **7** (15 mg ; 0,0022 mmol). The reaction was stirred at 50°C for 48h. The solvent was evaporated and the crude mixture purified by chromatography over silica gel.

White solid. MP = 157-160°C. ^1H NMR : δ = 5.58 (d, 1H, J = 9.0), 5.45 (dt, 1H, J = 14.6, J = 7.1), 5.23 (ddd, 1H, J = 14.6, J = 9.0, J = 5.5), 4.64 (m, 1H), 2.52 (bm, 1H), 2.28 (m, 1H), 1.82-2.20 (massif, 4H), 0.95-1.69 (massif, 12H). ^{13}C NMR : δ = 173.8, 135.8, 125.5 (q, J = 281.9), 124.7, 50.2 (q, J = 29.8), 37.1, 31.9 (q, J = 1.8), 31.6, 26.7, 26.1, 25.9, 25.7, 24.7, 24.4.

^{19}F NMR : $\delta = -76.69$ (d, $J = 6.8$). $\text{C}_{16}\text{H}_{26}\text{F}_3\text{NO}$: calcd : C (60.63), H (8.00), N (5.05). Found : C (60.70), H (8.27), N (4.78).

N-(diphenylmethylene) -2,2,2-chlorodifluoro-1-[(trimethylsilyl)oxy]-1-ethanamine (**14**) :

Same process than **1**.¹⁰

Yellow oil. Unstable product which must be synthesized just before use. ^1H NMR : $\delta = 7.25 - 7.80$ (massif, 10H), 5.24 (t, 1H, $J = 5.2$), 0.16 (s, 9H). ^{13}C NMR : $\delta = 174.8, 139.0, 135.8, 132.1, 130.1, 129.8, 129.2, 129.1$ (t, $J = 296.7$), 128.7, 128.3, 87.0 (t, $J = 29.4$), 1.3. ^{19}F NMR : $\delta = -68.48$ (ABX system, $J = 162.9, J = 5.2$).

N-(diphenylmethylene) -1,1,1-chlorodifluoro-4-penten-2-amine (**15**) :

Same process than **2**.¹⁰

Yellow oil. ^1H NMR : $\delta = 7.27 - 7.85$ (massif, 10H), 5.69 (ddt, 1H, $J = 17.1, J = 10.0, J = 7.2$), 5.16 - 5.24 (massif, 2H), 4.15 (ddt, 1H, $J = 7.6, J = 5.4, J = 8.3$), 2.74 - 2.80 (massif, 2H). ^{13}C NMR : $\delta = 172.6, 139.7, 136.4, 133.8, 131.3, 130.6$ (t, $J = 295.3$), 129.5, 129.3, 129.0, 128.64, 128.62, 119.0, 69.1 (t, $J = 23.3$), 36.1 (dd, $J = 2.5, J = 1.4$). ^{19}F NMR : $\delta = -58.77$ (ABX system, $J = 162.0, J = 8.3$). $\text{C}_{18}\text{H}_{16}\text{ClF}_2\text{N}$: calcd : C (67.61), H (5.04), N (4.38). Found : C (67.73), H (5.31), N (4.56).

1,1,1-chlorodifluoro-4-penten-2-amine hydrochloride (**16**) :

Same process than **3**.

White solid. Mp = 200°C (degradation). ^1H NMR (D_2O) : $\delta = 5.71$ (massif, 1H), 5.21 - 5.24 (massif, 2H), 4.69 (broad s, 3H), 4.15 (massif, 1H), 2.71 - 2.80 (massif, 1H), 2.41 - 2.53 (massif, 1H). ^{13}C NMR (D_2O) : $\delta = 129.9, 127.1$ (t, $J = 293.7$), 122.3, 57.1 (t, $J = 27.2$), 32.2 (t, $J = 2.2$). ^{19}F NMR (D_2O) : $\delta = -60.54$ (ABX system, $J = 172.9, J = 7.7$).

Benzyl *N*-[1-(chlorodifluoromethyl)-3-butenyl] carbamate (**17**) :

Same process than **4**.

White solid (2 rotamers 93/7). Mp = 65-66°C. ^1H NMR : δ = 7.30 – 7.40 (massif, 5H), 5.77 (ddt, 1H, J = 16.7, J = 9.6, J = 7.2), 5.10 - 5.24 (massif, 5H), 4.50 (ddt, 1H, J = 3.5, J = 18, J = 9.2), 2.65 (m, 1H), 2.32 (m, 1H). ^{13}C NMR : δ = 156.3, 136.3, 132.0, 129.8 (t, J = 297.2), 129.0, 128.7, 128.5, 119.9, 67.9, 57.9 (t, J = 26.4), 34.2. ^{19}F NMR : δ = -61.24 (ABX system, 0.93F, J = 164.0, J = 8.6), -61.39 (broad ABX system, 0.7F, J = 165.0). $\text{C}_{13}\text{H}_{14}\text{ClF}_2\text{NO}_2$: calcd : C (53.90), H (4.87), Cl (12.24), N (4.83). Found : C (53.82), H (4.91), Cl (12.51), N (4.71).

Benzyl *N*-allyl-*N*-[1-(chlorodifluoromethyl)-3-butenyl] carbamate (**18**) :

Same process than **5a**.

Colorless oil (2 rotamers). ^1H NMR : δ = 7.35 – 7.38 (massif, 5H), 5.60 – 6.01 (massif, 2H), 4.90 – 5.30 (massif, 7H), 3.92 (m, 2H), 2.60 (m, 2H). ^{13}C NMR : δ = 157.5, 156.1, 136.6, 134.9, 134.4, 132.6, 132.5, 129.9 (t, J = 298.6), 129.7 (t, J = 299.2), 128.92, 128.86, 128.6, 128.5, 128.4, 128.2, 119.4, 119.2, 117.5, 117.3, 68.3, 68.3, 62.4 (broad m), 46.4, 30.6. ^{19}F NMR : δ = -58.56 (broad ABX system, J = 167.0). $\text{C}_{16}\text{H}_{18}\text{ClF}_2\text{NO}_2$: calcd : C (58.27), H (5.50), Cl (10.75). Found : C (58.49), H (5.38), Cl (11.02).

N-(benzyloxycarbonyl)-6-(chlorodifluoromethyl)-1,2,5,6-tetrahydropyridine (**19**) :

Same process than **8a**.

Colorless oil (2 rotamers). ^1H NMR : δ = 7.32 – 7.44 (massif, 5H), 5.61 – 5.84 (massif, 2H), 4.89 – 5.30 (massif, 3H), 4.39 (m, 1H), 3.74 (m, 1H), 2.56 (m large, 2H). ^{13}C NMR : δ = 156.4, 155.6, 136.6, 136.5, 130.5 (t, J = 301.3), 130.3 (t, J = 301.6), 129.0, 128.7, 128.6,

128.4, 123.5, 123.0, 121.6, 121.1, 68.3, 41.5, 41.4, 23.7, 23.5, 55.5 (dd, $J = 26.9$, $J = 24.1$), 54.8 (dd, $J = 26.9$, $J = 23.6$). ^{19}F NMR : $\delta = -59.34$ (ABX system, $J = 163.2$, $J = 12.9$), -59.35 (ABX system, $J = 162.3$, $J = 12.6$). $\text{C}_{14}\text{H}_{14}\text{ClF}_2\text{NO}_2$: calcd : C (55.73), H (4.68), Cl (11.75), N (4.64). Found : C (55.86), H (4.70), Cl (11.93), N (4.55).