Supporting Information

Facial Access to 2,2-Difluoro-2,3-dihydrofuran Skeleton without Extra Additive: DMF-Promoted Difluorocarbene Formation of ClCF₂CO₂Na

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General Information

$^1$H, $^{13}$C NMR and $^{19}$F spectra were recorded on BRUKER DRX-400 spectrometer. Chemical shifts are reported relative to the residual solvent signal. The chemical shifts are referenced to signals at 7.26 and 77.0 ppm, respectively. Multiplicity was indicated as follows: s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet), td (triplet of doublets), dt (doublet of triplets), ddd (doublet of doublet of doublets). The data of HRMS were carried out on a high-resolution mass spectrometer (LCMS-IT-TOF). Melting points were determined with Büchi Melting Point B-545 instrument. TLC was performed by using commercially prepared 200-300 mesh silica gel plates and visualization effected at 254 nm. Unless stated otherwise, all reagents and solvents were purchased from commercial suppliers and used without further purification. Previously reported compounds were synthesized according to literature procedures. Synthetic methods and spectral data were consistent with the methods and data reported in the literatures.

General Procedure for the Synthesis of Enaminones 1

\[
\begin{align*}
\text{Synthesis of 1: In a 100 mL round-bottom flask, aryl methyl ketone S1 (5 mmol), DMF-DMA (10 mL) were successively added, the mixture was stirred at 105 °C. The reaction was stopped when S1 disappeared. Then the reaction cooled to room temperature and evaporated in vacuo to an oil, which crystallized with the addition of hexane to give the product 1.}
\end{align*}
\]

General Procedure for the Synthesis of Products 2

To a 20 mL sealed tube with magnetic stirrer bar, ClCF$_2$COONa (0.30 mmol), enaminone 1 (0.20 mmol) and DMF (2.0 mL), were successively added and vigorously stirred together at 90 °C for 24 hours. After the reaction was finished, the mixture was cooled to room temperature. The reaction was diluted with EtOAc (20 mL) and washed with NH$_4$Cl aq (3 $\times$ 15 mL). The ethyl
acetate layer was washed with brine (10 mL) and dried over anhydrous Na$_2$SO$_4$. The solvent was removed under vacuum. The crude product was purified by flash column chromatography (eluting with petroleum ether/ethyl acetate) on silica gel to afford product 2.

**Gram synthesis of 2,2-Difluoro-2,3-dihydrofuran 2w**

To a 100 mL sealed tube with magnetic stirrer bar, ClCF$_2$COONa (9.0 mmol), enaminone 1w (6 mmol) and DMF (25 mL), were successively added and vigorously stirred together at 90 °C for 24 hours. After the reaction was finished, the mixture was cooled to room temperature. The reaction was diluted with EtOAc (150 mL) and washed with NH$_4$Cl aq (3 × 60 mL). The ethyl acetate layer was washed with brine (60 mL) and dried over anhydrous Na$_2$SO$_4$. The solvent was removed under vacuum. The crude product was purified by flash column chromatography (eluting with petroleum ether/ethyl acetate) on silica gel to afford product 2w 1.18 g, 65% yield.

**X-ray Crystallographic Data of Compound 2f**

The X-ray crystallographic structure for 2f. ORTEP representation with 50% probability thermal ellipsoids. Crystal data have been deposited to CCDC number 2190192.
The Antiproliferative Activity of 2,2-Difluoro-2,3-dihydrofuran Products

The compounds were evaluated for their in vitro cytotoxicity against the human cancer cell lines Hela, MCF7, and HepG2 by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium Bromide (MTT) assay. The cancer cell lines were purchased from American Type Culture Collection (ATCC). Hela cells, MCF7 cells, and HepG2 cells were grown in DMEM medium. The medium for all cell lines were supplemented with 10% fetal bovine serum (FBS, Invitrogen, Carlsbad, CA) and 1% penicillin-streptomycin (Life Technologies, USA) and maintained in a humidified incubator at 37°C adjusted to 5% CO₂. Cells were seeded into 96-well plates at a density of 5000 cells/well. On the next day, medium containing the new compounds at different concentrations was added into per well for at least three cell doublings and incubated at 37°C for another 48 h, with 5-
Fluorouracil (FU) as the positive control. At the indicated time, the culture medium was replaced with 100 μL medium containing 10% MTT solution (5 mg/mL in PBS) and further incubated for 4 h. The absorbance was detected with a microplate reader at a wavelength of 570 nm. The IC_{50} values were calculated by plotting the percentage viability versus concentration on a logarithmic graph and reading of the concentration at which 50% of cells remained viable relative to the control. Each experiment was repeated at least three times to obtain the mean values.

**Characterization Data for All Products**

![Structure of 2,2-difluoro-N, N-dimethyl-5-(ρ-tolyl)-2,3-dihydrofuran-3-amine (2a)](image)

2,2-difluoro-N, N-dimethyl-5-(ρ-tolyl)-2,3-dihydrofuran-3-amine (2a)

Yellow solid, m.p. = 71-73 °C (40.6 mg, 85% yield).

$^1$H NMR (400 MHz, Chloroform-d) $\delta$ 7.49 (d, $J = 8.2$ Hz, 2H), 7.20 (d, $J = 8.0$ Hz, 2H), 5.48 (t, $J = 2.4$ Hz, 1H), 4.14 (ddd, $J = 15.1$, 7.2, 2.6 Hz, 1H), 2.48 (s, 6H), 2.37 (s, 3H). $^{13}$C NMR (101 MHz, Chloroform-d) $\delta$ 154.50 (d, $J = 3.7$ Hz), 140.15, 131.22 (dd, $J = 273.8$, 271.1 Hz), 129.26, 125.47, 125.28, 96.38 (d, $J = 3.0$ Hz), 71.04 (dd, $J = 34.6$, 18.9 Hz), 41.13 (d, $J = 2.9$ Hz), 21.44. $^{19}$F NMR (377 MHz, Chloroform-d) $\delta$ -61.29 (d, $J = 150.6$ Hz), -83.92 (d, $J = 150.8$ Hz). HRMS-ESI (m/z): calcd for C_{13}H_{15}F_{2}NO, [M+H]^+: 240.1200, found, 240.1193.

![Structure of 5-(1,1'-biphenyl-4-yl)-2,2-difluoro-N, N-dimethyl-2,3-dihydrofuran-3-amine (2b)](image)

5-(1,1'-biphenyl-4-yl)-2,2-difluoro-N, N-dimethyl-2,3-dihydrofuran-3-amine (2b)

Yellow solid, m.p. = 133-135 °C (54.1 mg, 90% yield).

$^1$H NMR (400 MHz, Chloroform-d) $\delta$ 7.66 (s, 2H), 7.64 – 7.59 (m, 4H), 7.46 (d, $J = 7.2$ Hz, 2H), 7.38 (d, $J = 7.3$ Hz, 1H), 5.58 (t, $J = 2.4$ Hz, 1H), 4.17 (ddd, $J = 15.0$, 7.3, 2.6 Hz, 1H), 2.50 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-d) $\delta$ 154.15 (d, $J = 3.8$ Hz), 142.69, 140.16, 131.22 (dd, $J = 274.0$, 271.4 Hz), 128.92, 127.84, 127.25, 127.08, 125.81, 97.47 (d, $J = 2.9$ Hz), 71.09 (dd, $J = 34.5$, 19.0 Hz), 41.19 (d, $J = 2.8$ Hz). $^{19}$F NMR (377 MHz, Chloroform-d) $\delta$ -61.26 (d, $J = 150.7$ Hz), -83.80 (d, $J = 150.6$ Hz). HRMS-ESI (m/z): calcd for C_{18}H_{17}F_{2}NO, [M+H]^+: 302.1356, found, 302.1345.

![Structure of 2,2-difluoro-N, N-dimethyl-5-(4-phenoxyphenyl)-2,3-dihydrofuran-3-amine (2c)](image)

2,2-difluoro-N, N-dimethyl-5-(4-phenoxyphenyl)-2,3-dihydrofuran-3-amine (2c)

Dark yellow solid, m.p. = 56-58 °C (51.3 mg, 81% yield).
\[ \text{F}_3\text{CO} \]

2,2-difluoro-\( \text{N}, \text{N} \)-dimethyl-5-(4-(trifluoromethoxy)phenyl)-2,3-dihydrofuran-3-amine (2d)

Yellow oil, (44.4 mg, 72% yield).

\[ \begin{align*} \text{H NMR} (400 \text{ MHz, Chloroform-}d) \delta &\ 7.64 \ (d, J = 8.6 \text{ Hz, 2H}), \ 7.24 \ (d, J = 8.4 \text{ Hz, 2H}), \ 5.56 \ (s, 1\text{H}), \ 4.16 \ (\text{ddd, } J = 14.9, 7.4, 2.4 \text{ Hz, 1H}), \ 2.48 \ (s, 6\text{H}). \end{align*} \]

\[ \text{C NMR} (101 \text{ MHz, Chloroform-}d) \delta \ 153.02 \ (d, J = 3.6 \text{ Hz}), \ 141.30, \ 131.18 \ (\text{dd, } J = 274.1, 271.1 \text{ Hz}), \ 125.85, \ 124.71, \ 96.67 \ (d, J = 3.2 \text{ Hz}), \ 71.06 \ (d, J = 3.4, 19.0 \text{ Hz}), \ 41.14 \ (d, J = 2.9 \text{ Hz}), \ 15.27. \]

\[ \text{F NMR} (377 \text{ MHz, Chloroform-}d) \delta -61.36 \ (d, J = 150.7 \text{ Hz}), \ -83.82 \ (d, J = 150.5 \text{ Hz}), \ -83.78 \ (d, J = 150.5 \text{ Hz}). \]

HRMS-ESI (m/z): calcd for C\(_{13}\)H\(_{12}\)F\(_2\)NO\(_2\), [M+H]\(^+\): 310.0866, found, 310.0851.

\[ \begin{align*} \text{MeS} \quad \text{O} \quad \text{N} \quad \text{F} \quad \text{F} \quad \text{Me} \\
\end{align*} \]

2,2-difluoro-\( \text{N}, \text{N} \)-dimethyl-5-(4-(methylthio)phenyl)-2,3-dihydrofuran-3-amine (2e)

Yellow solid, m.p. = 88-90 °C (40.1 mg, 74% yield).

\[ \begin{align*} \text{H NMR} (400 \text{ MHz, Chloroform-}d) \delta &\ 7.50 \ (d, J = 8.4 \text{ Hz, 2H}), \ 7.23 \ (d, J = 8.4 \text{ Hz, 2H}), \ 5.49 \ (t, J = 2.0 \text{ Hz, 1H}), \ 4.13 \ (\text{ddd, } J = 15.1, 7.3, 2.8 \text{ Hz, 1H}), \ 2.49 \ (s, 3\text{H}), \ 2.47 \ (s, 6\text{H}). \end{align*} \]

\[ \text{C NMR} (101 \text{ MHz, Chloroform-}d) \delta \ 153.98 \ (d, J = 3.6 \text{ Hz}), \ 141.30, \ 131.18 \ (\text{dd, } J = 274.1, 271.1 \text{ Hz}), \ 125.85, \ 124.71, \ 96.67 \ (d, J = 3.2 \text{ Hz}), \ 71.06 \ (d, J = 3.4, 19.0 \text{ Hz}), \ 41.14 \ (d, J = 2.9 \text{ Hz}), \ 15.27. \]

\[ \text{F NMR} (377 \text{ MHz, Chloroform-}d) \delta -61.36 \ (d, J = 150.7 \text{ Hz}), \ -83.82 \ (d, J = 150.5 \text{ Hz}), \ -83.78 \ (d, J = 150.5 \text{ Hz}). \]

HRMS-ESI (m/z): calcd for C\(_{13}\)H\(_{15}\)F\(_2\)NOS, [M+H]\(^+\): 272.0921, found, 272.0922.

\[ \begin{align*} \text{Cl} \quad \text{O} \quad \text{N} \quad \text{F} \quad \text{F} \quad \text{Me} \\
\end{align*} \]

5-(4-chlorophenyl)-2,2-difluoro-\( \text{N}, \text{N} \)-dimethyl-2,3-dihydrofuran-3-amine (2f) \(^1\)

Dark yellow solid, m.p. = 58-60 °C (35.2 mg, 68% yield).

\[ \begin{align*} \text{H NMR} (400 \text{ MHz, Chloroform-}d) \delta &\ 7.53 \ (d, J = 8.5 \text{ Hz, 2H}), \ 7.37 \ (d, J = 8.6 \text{ Hz, 2H}), \ 5.54 \ (q, J = 2.8 \text{ Hz, 1H}), \ 4.15 \ (\text{dd, } J = 14.9, 7.4 \text{ Hz, 1H}), \ 2.48 \ (s, 6\text{H}). \end{align*} \]

\[ \text{C NMR} (101 \text{ MHz, Chloroform-}d) \delta \ 153.29 \ (d, J = 3.8 \text{ Hz}), \ 135.86, \ 131.11 \ (\text{dd, } J = 274.5, 271.8 \text{ Hz}), \ 128.87, \ 126.67, \ 126.63, \ 97.98 \ (d, \text{J} = 2.8 \text{ Hz}). \]

HRMS-ESI (m/z): calcd for C\(_{13}\)H\(_{15}\)F\(_2\)NOS, [M+H]\(^+\): 272.0921, found, 272.0922.
5-(4-bromophenyl)-2,2-difluoro-N,N-dimethyl-2,3-dihydrofuran-3-amine (2g)

Yellow solid, m.p. = 53-55 °C (43.1 mg, 71% yield).

1H NMR (400 MHz, Chloroform-d) δ 7.53 (d, J = 8.3 Hz, 2H), 7.46 (d, J = 8.3 Hz, 2H), 5.56 (s, 1H), 4.14 (ddd, J = 14.9, 7.4, 2.2 Hz, 1H), 2.48 (s, 6H).

13C NMR (101 MHz, Chloroform-d) δ 153.35 (d, J = 3.8 Hz), 131.82, 131.10 (dd, J = 274.7, 271.7 Hz), 127.11, 126.83, 124.16, 98.13 (d, J = 2.7 Hz), 71.07 (dd, J = 34.5, 19.0 Hz), 41.16 (d, J = 2.3 Hz).

19F NMR (377 MHz, Chloroform-d) δ -61.38 (d, J = 150.5 Hz), -83.66 (d, J = 150.5 Hz). HRMS-ESI (m/z): calcd for C12H12BrF2NO, [M+H]+: 304.0149, found, 304.0155.

4-(4-(dimethylamino)-5,5-difluoro-4,5-dihydrofuran-2-yl)benzonitrile (2h)

Yellow solid, m.p. = 48-50 °C (26.5 mg, 53% yield).

1H NMR (400 MHz, Chloroform-d) δ 7.70 (s, 4H), 5.74 (s, 1H), 4.19 (dd, J = 14.7, 7.7 Hz, 1H), 2.49 (s, 6H).

13C NMR (101 MHz, Chloroform-d) δ 152.39 (d, J = 3.9 Hz), 130.99 (d, J = 3.7 Hz), 132.41, 132.19 (d, J = 3.1 Hz), 125.84, 118.26, 113.28, 101.27 (d, J = 2.9 Hz), 71.07 (dd, J = 34.4, 19.1 Hz), 41.24 (d, J = 2.4 Hz).

19F NMR (377 MHz, Chloroform-d) δ -61.47 (d, J = 150.2 Hz), -83.38 (d, J = 150.2 Hz). HRMS-ESI (m/z): calcd for C13H12F2N2O, [M+H]+: 251.0996, found, 251.1015.

2,2-difluoro-N,N-dimethyl-5-(4-nitrophenyl)-2,3-dihydrofuran-3-amine (2i)

Yellow solid, m.p. = 81-83 °C (24.3 mg, 45% yield).

1H NMR (400 MHz, Chloroform-d) δ 8.27 (d, J = 8.5 Hz, 2H), 7.77 (d, J = 8.5 Hz, 2H), 5.81 (s, 1H), 4.21 (ddd, J = 15.1, 7.9, 2.8 Hz, 1H), 2.50 (s, 6H).

13C NMR (101 MHz, Chloroform-d) δ 152.14 (d, J = 3.8 Hz), 148.33, 133.89, 130.98 (dd, J = 275.9, 272.4 Hz), 126.15, 123.94, 102.05 (d, J = 3.3 Hz), 71.13 (dd, J = 34.3, 19.1 Hz), 41.26 (d, J = 2.9 Hz).

19F NMR (377 MHz, Chloroform-d) δ -61.48 (d, J = 150.1 Hz), -83.27 (d, J = 149.9 Hz). HRMS-ESI (m/z): calcd for C12H12F2N2O3, [M+H]+: 271.0894, found, 271.0873.
2,2-difluoro-5-(3-methoxyphenyl)-N, N-dimethyl-2,3-dihydrofuran-3-amine (2j) \[1\]
Yellow oil, (37.7 mg, 74% yield).
\[^1\]H NMR (400 MHz, Chloroform-d) \(\delta\) 7.30 (t, \(J = 7.8\) Hz, 1H), 7.20 (d, \(J = 7.6\) Hz, 1H), 7.12 (s, 1H), 6.93 (d, \(J = 8.1\) Hz, 1H), 5.54 (s, 1H), 4.14 (dd, \(J = 15.0, 7.3\) Hz, 1H), 3.84 (s, 3H), 2.48 (s, 6H).
\[^{13}\]C NMR (101 MHz, Chloroform-d) \(\delta\) 159.71, 154.17 (d, \(J = 3.6\) Hz), 131.16 (dd, \(J = 274.1, 271.4\) Hz), 129.65, 129.51, 117.82, 115.90, 110.50, 97.77 (d, \(J = 3.0\) Hz), 71.03 (dd, \(J = 34.5, 19.0\) Hz), 55.37, 41.16 (d, \(J = 2.8\) Hz).
\[^{19}\]F NMR (377 MHz, Chloroform-d) \(\delta\) -61.32 (d, \(J = 150.7\) Hz), -83.82 (d, \(J = 150.7\) Hz).
HRMS-ESI (m/z): calcd for C\(_{13}\)H\(_{15}\)F\(_2\)NO\(_2\), [M+H]\(^+\): 256.1149, found, 256.1130.

2,2-difluoro-N, N-dimethyl-5-(3-(trifluoromethyl)phenyl)-2,3-dihydrofuran-3-amine (2k)
Yellow oil, (32.8 mg, 56% yield).
\[^1\]H NMR (400 MHz, Chloroform-d) \(\delta\) 7.85 (s, 1H), 7.78 (d, \(J = 7.9\) Hz, 1H), 7.65 (d, \(J = 7.8\) Hz, 1H), 7.53 (t, \(J = 7.8\) Hz, 1H), 5.67 (s, 1H), 4.19 (dd, \(J = 14.6, 7.2\) Hz, 1H), 2.49 (s, 6H).
\[^{13}\]C NMR (101 MHz, Chloroform-d) \(\delta\) 152.83 (d, \(J = 3.7\) Hz), 131.23 (q, \(J = 32.5\) Hz), 131.03, 129.19, 129.01, 128.45, 126.44 (q, \(J = 3.6\) Hz), 122.18 (q, \(J = 3.8\) Hz), 99.20 (d, \(J = 2.8\) Hz), 71.05 (dd, \(J = 34.4, 19.0\) Hz), 41.17 (d, \(J = 2.8\) Hz).
\[^{19}\]F NMR (377 MHz, Chloroform-d) \(\delta\) -61.49 (d, \(J = 150.4\) Hz), -62.93, -83.65 (d, \(J = 150.4\) Hz).
HRMS-ESI (m/z): calcd for C\(_{13}\)H\(_{12}\)F\(_5\)NO, [M+H]\(^+\): 294.0917, found, 294.0902.

2,2-difluoro-N, N-dimethyl-5-(o-tolyl)-2,3-dihydrofuran-3-amine (2l) \[1\]
Yellow oil, (27.7 mg, 58% yield).
\[^1\]H NMR (400 MHz, Chloroform-d) \(\delta\) 7.57 – 7.53 (m, 1H), 7.32 – 7.27 (m, 1H), 7.24 (t, \(J = 5.9\) Hz, 2H), 5.35 (t, \(J = 2.1\) Hz, 1H), 4.16 (ddd, \(J = 15.2, 7.2, 2.6\) Hz, 1H), 2.52 (s, 6H), 2.46 (s, 3H).
\[^{13}\]C NMR (101 MHz, Chloroform-d) \(\delta\) 154.60 (d, \(J = 3.6\) Hz), 136.70, \(\delta\) 133.43 – 128.01 (m), 131.08, 129.70, 128.20, 128.03, 125.93, 101.68 (d, \(J = 2.7\) Hz), 71.07 (dd, \(J = 34.7, 18.9\) Hz), 41.15 (d, \(J = 2.8\) Hz), 21.46.
\[^{19}\]F NMR (377 MHz, Chloroform-d) \(\delta\) -61.71 (d, \(J = 151.7\) Hz), -84.94 (d, \(J = 151.6\) Hz).
HRMS-ESI (m/z): calcd for C\(_{13}\)H\(_{15}\)F\(_2\)NO, [M+H]\(^+\): 240.1200, found, 240.1193 .
5-(3,4-difluorophenyl)-2,2-difluoro-N,N-dimethyl-2,3-dihydrofuran-3-amine (2m)
Yellow oil, (31.8 mg, 61% yield).
$^1$H NMR (400 MHz, Chloroform-d) $\delta$ 7.44 – 7.33 (m, 2H), 7.19 (q, $J = 8.7$ Hz, 1H), 5.53 (s, 1H), 4.16 (dd, $J = 14.8, 7.4$ Hz, 1H), 2.48 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-d) $\delta$ 152.04 (dd, $J = 89.2, 12.9$ Hz), 152.30 – 152.15 (m), 149.55 (dd, $J = 85.5, 13.0$ Hz), 131.02 (dd, $J = 275.1, 272.1$ Hz), 125.31 (dd, $J = 6.6, 4.0$ Hz), 121.81 (dd, $J = 6.7, 3.8$ Hz), 117.68 (d, $J = 17.9$ Hz), 114.65 (d, $J = 19.4$ Hz), 98.37, 71.08 (dd, $J = 34.3, 19.0$ Hz), 41.12 (d, $J = 2.3$ Hz). $^{19}$F NMR (377 MHz, Chloroform-d) $\delta$ -61.51 (d, $J = 150.9$ Hz), -83.67 (d, $J = 150.5$ Hz), -136.62 (d, $J = 21.0$ Hz). HRMS-ESI (m/z): calcd for C$_{12}$H$_{11}$F$_4$NO, [M+H]$^+$: 262.0855, found, 262.0841.

5-(3-chloro-4-fluorophenyl)-2,2-difluoro-N,N-dimethyl-2,3-dihydrofuran-3-amine (2n)
Yellow oil, (36.0 mg, 65% yield).
$^1$H NMR (400 MHz, Chloroform-d) $\delta$ 7.65 (d, $J = 5.2$ Hz, 1H), 7.48 (s, 1H), 7.17 (t, $J = 8.6$ Hz, 1H), 5.53 (s, 1H), 4.15 (dd, $J = 14.3, 6.9$ Hz, 1H), 2.48 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-d) $\delta$ 158.84 (d, $J = 253.1$ Hz), 152.10 (d, $J = 3.0$ Hz), 131.04 (dd, $J = 275.2, 272.2$ Hz), 127.80, 125.31 (d, $J = 3.9$ Hz), 125.32 (d, $J = 7.6$ Hz), 121.67 (d, $J = 18.4$ Hz), 116.91 (d, $J = 21.8$ Hz), 98.39, 71.08 (dd, $J = 34.3, 19.0$ Hz), 41.17. $^{19}$F NMR (377 MHz, Chloroform-d) $\delta$ -61.51 (d, $J = 150.9$ Hz), -83.67 (d, $J = 150.5$ Hz), -136.62 (d, $J = 21.0$ Hz). HRMS-ESI (m/z): calcd for C$_{12}$H$_{11}$ClF$_3$NO, [M+H]$^+$: 278.0560, found, 278.0512.

5-(3-bromo-4-methoxyphenyl)-2,2-difluoro-N,N-dimethyl-2,3-dihydrofuran-3-amine (2o)
Yellow oil, (45.4 mg, 68% yield).
$^1$H NMR (400 MHz, Chloroform-d) $\delta$ 7.79 (s, 1H), 7.52 (d, $J = 8.5$ Hz, 1H), 6.90 (d, $J = 8.6$ Hz, 1H), 5.43 (s, 1H), 4.14 (ddd, $J = 15.1, 7.2, 2.1$ Hz, 1H), 3.92 (s, 3H), 2.47 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-d) $\delta$ 157.04, 152.78 (d, $J = 3.8$ Hz), 131.10 (dd, $J = 274.3, 271.5$ Hz), 130.39, 125.83, 122.17, 111.92, 111.56, 96.45 (d, $J = 2.6$ Hz), 71.07 (dd, $J = 34.5, 19.0$ Hz), 56.37, 41.14 (d, $J = 2.2$ Hz). $^{19}$F NMR (377 MHz, Chloroform-d) $\delta$ -61.43 (d, $J = 150.5$ Hz), -83.84 (d, $J = 150.5$ Hz). HRMS-ESI (m/z): calcd for C$_{13}$H$_{14}$BrF$_2$NO$_2$, [M+H]$^+$: 334.0254, found, 334.0259.
5-(4-(allyloxy)-3-methoxyphenyl)-2,2-difluoro-N,N-dimethyl-2,3-dihydrofuran-3-amine (2p)

Brown oil, (47.8 mg, 77% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 7.17 (d, $J$ = 8.4 Hz, 1H), 7.09 (s, 1H), 6.87 (d, $J$ = 8.3 Hz, 1H), 6.07 (ddt, $J$ = 17.0, 10.2, 5.3 Hz, 1H), 5.40 (d, $J$ = 11.9 Hz, 2H), 5.30 (d, $J$ = 10.4 Hz, 1H), 4.64 (d, $J$ = 4.7 Hz, 2H), 4.15 (dd, $J$ = 14.9, 6.9 Hz, 1H), 3.91 (s, 3H), 2.49 (s, 6H).

$^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 154.20 (d, $J$ = 3.8 Hz), 149.47, 149.33, 131.16 (dd, $J$ = 273.7, 271.3 Hz), 132.79, 121.30, 118.46, 118.31, 112.92, 108.58, 95.58 (d, $J$ = 2.5 Hz), 71.06 (dd, $J$ = 34.6, 18.9 Hz), 69.78, 56.02, 41.08 (d, $J$ = 2.4 Hz).

$^{19}$F NMR (377 MHz, Chloroform-$d$) $\delta$ -61.26 (d, $J$ = 150.8 Hz), -83.88 (d, $J$ = 150.8 Hz).

HRMS-ESI (m/z): calcd for C$_{15}$H$_{17}$F$_2$NO$_3$, [M+H]$^+$: 298.1255, found, 298.1252.

5-(4-(difluoromethoxy)-3-methoxyphenyl)-2,2-difluoro-N,N-dimethyl-2,3-dihydrofuran-3-amine (2q)

Dark yellow oil, (42.3 mg, 66% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 7.19 (d, $J$ = 4.2 Hz, 3H), 6.58 (t, $J$ = 74.8 Hz, 1H), 5.54 (t, $J$ = 2.4 Hz, 1H), 4.16 (ddd, $J$ = 15.0, 7.4, 2.7 Hz, 1H), 3.93 (s, 3H), 2.49 (s, 6H).

$^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 153.32 (d, $J$ = 3.8 Hz), 151.12, 141.03 (t, $J$ = 3.1 Hz), 131.09 (dd, $J$ = 274.6, 271.8 Hz), 126.73, 122.25, 118.29, 115.88 (t, $J$ = 260.8 Hz), 109.60, 97.95 (d, $J$ = 3.1 Hz), 71.08 (dd, $J$ = 34.5, 19.0 Hz), 56.14, 41.15 (d, $J$ = 2.8 Hz).

$^{19}$F NMR (377 MHz, Chloroform-$d$) $\delta$ -61.39 (d, $J$ = 150.5 Hz), -81.71, -83.73 (d, $J$ = 150.5 Hz).

HRMS-ESI (m/z): calcd for C$_{14}$H$_{15}$F$_4$NO$_3$, [M+H]$^+$: 322.1066, found, 322.1094.

2,2-difluoro-N,N-dimethyl-5-(3,4,5-trimethoxyphenyl)-2,3-dihydrofuran-3-amine (2r)

Yellow solid, m.p. = 83-85 °C (52.2 mg, 83% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 6.82 (s, 2H), 5.47 (s, 1H), 4.14 (ddd, $J$ = 15.1, 7.3, 2.7 Hz, 1H), 3.89 (s, 6H), 3.87 (s, 3H), 2.48 (s, 6H).

$^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 154.09 (d, $J$ = 3.8 Hz), 153.34, 139.72, 131.11 (dd, $J$ = 274.1, 271.5 Hz), 123.63, 102.69, 96.89 (d, $J$ = 2.7 Hz), 75.85 (d, $J$ = 2.7 Hz).
71.08 (dd, $J = 34.6, 18.9$ Hz), 60.95, 56.25, 41.14 (d, $J = 2.8$ Hz). $^{19}$F NMR (377 MHz, Chloroform-$d$) $\delta$ -61.33 (d, $J = 150.6$ Hz), -83.82 (d, $J = 150.6$ Hz). HRMS-ESI (m/z): calcd for C$_{15}$H$_{16}$F$_2$NO$_4$, [M+H]$^+$: 316.1360, found, 316.1351.

![5-(benzod[1,3]dioxol-5-yl)-2,2-difluoro-N,N-dimethyl-2,3-dihydrofuran-3-amine (2s)](image)

Dark yellow oil, (41.9 mg, 78% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 7.13 (d, $J = 8.1$ Hz, 1H), 7.04 (d, $J = 2.2$ Hz, 1H), 6.81 (d, $J = 8.1$ Hz, 1H), 6.00 – 5.97 (m, 2H), 5.39 – 5.36 (m, 1H), 4.12 (dd, $J = 14.9, 7.1$ Hz, 1H), 2.47 (s, 6H).

$^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 153.99 (d, $J = 3.7$ Hz), 149.05, 147.93, 131.12 (dd, $J = 273.9, 271.1$ Hz), 122.31, 119.90, 108.35, 105.63, 101.49, 95.78 (d, $J = 3.1$ Hz), 71.02 (dd, $J = 34.5, 18.9$ Hz), 41.07 (d, $J = 2.9$ Hz). $^{19}$F NMR (377 MHz, Chloroform-$d$) $\delta$ -61.35 (d, $J = 150.9$ Hz), -83.90 (d, $J = 150.8$ Hz). HRMS-ESI (m/z): calcd for C$_{13}$H$_{13}$F$_2$NO$_3$, [M+H]$^+$: 270.0942, found, 270.0944.

![5-(2,3-dihydrobenzofuran-5-yl)-2,2-difluoro-N,N-dimethyl-2,3-dihydrofuran-3-amine (2t)](image)

Yellow solid, m.p. = 60-62 °C (38.4 mg, 72% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 7.44 (s, 1H), 7.39 (d, $J = 8.4$ Hz, 1H), 6.78 (d, $J = 8.4$ Hz, 1H), 5.35 (s, 1H), 4.61 (t, $J = 8.7$ Hz, 2H), 4.13 (dd, $J = 14.8, 5.7$ Hz, 1H), 3.22 (t, $J = 8.7$ Hz, 2H), 2.48 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 161.65, 154.56, 141.73, 131.15 (dd, $J = 273.4, 271.0$ Hz), 94.59 (d, $J = 2.5$ Hz), 127.60, 126.03, 122.24, 120.85, 109.37, 94.59 (d, $J = 2.5$ Hz), 71.04 (dd, $J = 34.6, 18.9$ Hz), 41.04 (d, $J = 2.6$ Hz), 29.33. $^{19}$F NMR (377 MHz, Chloroform-$d$) $\delta$ -61.28 (d, $J = 150.9$ Hz), -83.90 (d, $J = 150.8$ Hz). HRMS-ESI (m/z): calcd for C$_{14}$H$_{15}$F$_2$NO$_2$, [M+H]$^+$: 268.1149, found, 268.1140.

![5-(2,3-dihydrobenzo[b][1,4]dioxin-6-yl)-2,2-difluoro-N,N-dimethyl-2,3-dihydrofuran-3-amine (2u)](image)

Yellow oil, (37.3 mg, 66% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 7.10 (d, $J = 9.0$ Hz, 2H), 6.86 (d, $J = 8.2$ Hz, 1H), 5.38 (d, $J = 2.7$ Hz, 1H), 4.27 (s, 4H), 4.12 (dd, $J = 14.9, 7.1$ Hz, 1H), 2.47 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 153.96 (d, $J = 3.8$ Hz), 145.13, 143.50, 131.15 (dd, $J = 273.6, 271.1$ Hz), 121.73, 118.87, 117.46, 114.53, 95.72 (d, $J = 2.9$ Hz), 71.04 (dd, $J = 34.6, 18.9$ Hz), 64.51, 64.25.
41.08 (d, J = 2.4 Hz). $^{19}$F NMR (377 MHz, Chloroform-d) $\delta$ -61.34 (d, J = 151.0 Hz), -84.00 (d, J = 150.7 Hz). HRMS-ESI (m/z): calcd for C$_{14}$H$_{15}$F$_2$NO$_3$, [M+H]$^+$: 284.1098, found, 284.1093.

2,2-difluoro-N, N-dimethyl-5-(naphthalen-1-yl)-2,3-dihydrofuran-3-amine (2v)$^{[1]}$

Dark yellow oil, (35.7 mg, 65% yield). $^1$H NMR (400 MHz, Chloroform-d) $\delta$ 8.28 (d, J = 8.3 Hz, 1H), 7.88 (t, J = 8.8 Hz, 2H), 7.71 (d, J = 7.1 Hz, 1H), 7.57 – 7.51 (m, 2H), 7.57 (d, J = 7.8 Hz, 1H), 5.54 (t, J = 2.4 Hz, 1H), 4.23 (ddd, J = 15.3, 7.1, 2.6 Hz, 1H), 2.57 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-d) $\delta$ 154.69 (d, J = 3.7 Hz), 133.66, 131.06 (dd, J = 274.0, 271.3 Hz), 130.70, 130.54, 128.67, 127.13, 127.07, 126.36, 126.27, 124.95, 102.70 (d, J = 2.8 Hz), 71.08 (dd, J = 34.6, 18.8 Hz), 41.35 (d, J = 2.5 Hz). $^{19}$F NMR (377 MHz, Chloroform-d) $\delta$ -61.57 (d, J = 151.1 Hz), -84.57 (d, J = 151.1 Hz). HRMS-ESI (m/z): calcd for C$_{16}$H$_{15}$F$_2$NO, [M+H]$^+$: 276.1200, found, 276.1200.

2,2-difluoro-N, N-dimethyl-5-(naphthalen-2-yl)-2,3-dihydrofuran-3-amine (2w)$^{[1]}$

Yellow solid, m.p. = 57-59 $^\circ$C (41.8 mg, 76% yield). $^1$H NMR (400 MHz, Chloroform-d) $\delta$ 8.08 (s, 1H), 7.83 (dd, J = 12.5, 5.6 Hz, 3H), 7.65 – 7.59 (m, 1H), 7.50 (dd, J = 6.1, 3.2 Hz, 2H), 5.65 (s, 1H), 4.20 (ddd, J = 15.2, 7.5, 3.0 Hz, 1H), 2.51 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-d) $\delta$ 154.37 (d, J = 3.7 Hz), 133.84, 132.95, 131.28 (dd, J = 274.0, 271.3 Hz), 128.67, 128.38, 127.75, 127.16, 126.80, 125.33, 125.16, 122.36, 98.10 (d, J = 2.7 Hz), 71.16 (dd, J = 34.5, 18.9 Hz), 41.22 (d, J = 2.4 Hz). $^{19}$F NMR (377 MHz, Chloroform-d) $\delta$ -61.18 (d, J = 150.6 Hz), -83.60 (d, J = 150.6 Hz). HRMS-ESI (m/z): calcd for C$_{16}$H$_{15}$F$_2$NO, [M+H]$^+$: 276.1200, found, 276.1200.

2,2-difluoro-5-(6-methoxynaphthalen-2-yl)-N, N-dimethyl-2,3-dihydrofuran-3-amine (2x)

Yellow solid, m.p. = 113-115 $^\circ$C (50.0 mg, 82% yield). $^1$H NMR (400 MHz, Chloroform-d) $\delta$ 8.02 (s, 1H), 7.74 (dd, J = 15.6, 8.8 Hz, 2H), 7.60 (dd, J = 8.6, 1.6 Hz, 1H), 7.17 (dd, J = 8.9, 2.5 Hz, 1H), 7.13 (d, J = 2.3 Hz, 1H), 5.60 (t, J = 2.3 Hz, 1H), 4.20 (ddd, J = 15.0, 7.2, 2.6 Hz, 1H), 3.93 (s, 3H), 2.51 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-d) $\delta$ 158.68, 154.52 (d, J = 3.7 Hz), 153.23, 131.28 (dd, J = 274.0, 271.2 Hz), 130.17, 128.30, 127.16, 124.96, 123.23, 122.97, 119.55, 105.89, 96.98 (d, J = 2.6 Hz), 71.12 (dd, J = 34.5, 18.9 Hz), 55.35, 41.18 (d, J = 2.5 Hz). $^{19}$F NMR (377 MHz, Chloroform-d) $\delta$ -61.19 (d, J = 150.8 Hz),
2,2-difluoro-\(N\)-dimethyl-5-(2-(phenylethynyl)phenyl)-2,3-dihydrofuran-3-amine (2y)
Brown oil, (37.0 mg, 57% yield).
\(^1\)H NMR (400 MHz, Chloroform-\(d\)) \(\delta\) 7.61 – 7.55 (m, 1H), 7.54 – 7.48 (m, 1H), 7.40 (dd, \(J = 7.2\), \(2.3\) Hz, 2H), 7.30 – 7.22 (m, 5H), 6.24 – 6.17 (m, 1H), 4.09 (ddd, \(J = 15.0\), 7.5, 2.6 Hz, 1H), 2.38 (s, 6H).
\(^{13}\)C NMR (101 MHz, Chloroform-\(d\)) \(\delta\) 152.16 (d, \(J = 3.7\) Hz), 133.89, 131.45, 130.65 (dd, \(J = 273.0\), 270.0 Hz), 129.09, 129.00, 128.78, 128.54, 128.46, 126.98, 122.81, 120.71, 102.63 (d, \(J = 2.9\) Hz), 95.13, 88.46, 71.47 (dd, \(J = 34.5\), 19.1 Hz), 41.26. 
\(^{19}\)F NMR (377 MHz, Chloroform-\(d\)) \(\delta\) -61.81 (d, \(J = 151.2\) Hz), -84.37. HRMS-ESI (m/z): calcd for C\(_{17}\)H\(_{17}\)F\(_2\)NO, [M+H]+: 306.1306, found, 306.1308.

1-(4'-(4-(dimethylamino)-5,5-difluoro-4,5-dihydrofuran-2-yl)-[1,1'-biphenyl]-4-yl)ethan-1-one (2z)
Light yellow solid, m.p. = 145-147 °C (48.7 mg, 71% yield).
\(^1\)H NMR (400 MHz, Chloroform-\(d\)) \(\delta\) 8.04 (d, \(J = 8.0\) Hz, 2H), 7.68 (dd, \(J = 8.8\), 5.1 Hz, 6H), 5.63 (s, 1H), 4.18 (ddd, \(J = 15.1\), 7.4, 2.6 Hz, 1H), 2.64 (s, 3H), 2.50 (s, 6H).
\(^{13}\)C NMR (101 MHz, Chloroform-\(d\)) \(\delta\) 197.66, 153.85 (d, \(J = 3.7\) Hz), 144.59, 141.22, 136.23, 131.16 (dd, \(J = 274.3\), 271.4 Hz), 129.01, 127.96, 127.41, 127.17, 125.94, 98.07 (d, \(J = 3.0\) Hz), 71.07 (dd, \(J = 34.5\), 19.0 Hz), 41.19 (d, \(J = 2.7\) Hz), 26.70. 
\(^{19}\)F NMR (377 MHz, Chloroform-\(d\)) \(\delta\) -61.26 (d, \(J = 150.5\) Hz), -83.71 (d, \(J = 150.6\) Hz). HRMS-ESI (m/z): calcd for C\(_{20}\)H\(_{19}\)F\(_2\)NO\(_2\), [M+H]+: 344.1462, found, 344.1464.

(E)-2,2-difluoro-\(N\)-dimethyl-5-styryl-2,3-dihydrofuran-3-amine (2aa)
Dark yellow solid, m.p. = 46-48 °C (32.0 mg, 63% yield).
\(^1\)H NMR (400 MHz, Chloroform-\(d\)) \(\delta\) 7.46 – 7.43 (m, 2H), 7.38 – 7.33 (m, 2H), 7.32 – 7.28 (m, 1H), 7.01 (d, \(J = 16.1\) Hz, 1H), 6.55 (d, \(J = 16.1\) Hz, 1H), 5.21 (t, \(J = 2.3\) Hz, 1H), 4.09 (ddd, \(J = 14.7\), 7.3, 2.9 Hz, 1H), 2.47 (s, 6H). 
\(^{13}\)C NMR (101 MHz, Chloroform-\(d\)) \(\delta\) 153.56 (d, \(J = 3.8\) Hz),
135.66, 131.19 (dd, J = 274.2, 271.2 Hz), 133.63, 128.83, 128.79, 127.03, 114.76, 101.93 (d, J = 2.7 Hz), 70.92 (dd, J = 34.3, 19.1 Hz), 41.17 (d, J = 2.4 Hz). $^{19}$F NMR (377 MHz, Chloroform-d) δ -61.39 (d, J = 150.1 Hz), -83.47 (d, J = 150.0 Hz). HRMS-ESI (m/z): calcd for C$_{14}$H$_{15}$F$_2$NO, [M+H]$^+$: 252.1200, found, 252.1136.

**2,2-difluoro-N,N-dimethyl-5-(4-((2-methyl-1H-indol-1-yl)methyl)phenyl)-2,3-dihydrofuran-3-amine (2ab)**

Yellow solid, m.p. = 86-88 °C (45.6 mg, 62% yield).

$^1$H NMR (400 MHz, Chloroform-d) δ 7.60 – 7.53 (m, 1H), 7.49 (d, J = 8.2 Hz, 2H), 7.20 – 7.13 (m, 1H), 7.09 (qd, J = 6.9, 3.9 Hz, 2H), 6.98 (d, J = 8.2 Hz, 2H), 6.34 (s, 1H), 5.48 (t, J = 2.3 Hz, 1H), 5.32 (s, 2H), 4.11 (ddd, J = 15.0, 7.2, 2.6 Hz, 1H), 2.45 (s, 6H), 2.36 (s, 3H).

$^{13}$C NMR (101 MHz, Chloroform-d) δ 153.94 (d, J = 3.7 Hz), 139.89, 137.06, 136.54, 131.13 (dd, J = 274.2, 271.4 Hz), 128.20, 127.33, 126.22, 125.81, 120.91, 119.84, 119.69, 109.06, 100.73, 97.42, 70.99 (dd, J = 34.5, 18.9 Hz), 46.22, 41.15, 12.76. $^{19}$F NMR (377 MHz, Chloroform-d) δ -61.30 (d, J = 150.7 Hz), -83.90 (d, J = 150.8 Hz). HRMS-ESI (m/z): calcd for C$_{13}$H$_{15}$F$_2$NO, [M+H]$^+$: 252.1136, found, 252.1136.

**2,2-difluoro-N,N-dimethyl-5-(6-methylpyridin-2-yl)-2,3-dihydrofuran-3-amine (2ac)**

Dark yellow oil, (32.1 mg, 67% yield).

$^1$H NMR (400 MHz, Chloroform-d) δ 7.62 (t, J = 7.8 Hz, 1H), 7.38 (d, J = 7.9 Hz, 1H), 7.14 (d, J = 7.8 Hz, 1H), 6.06 (s, 1H), 4.20 – 4.14 (m, 1H), 2.57 (s, 3H), 2.49 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-d) δ 158.84, 153.72 (d, J = 3.3 Hz), 146.33, 136.84, 131.32 (dd, J = 274.9, 271.1 Hz), 124.03, 117.42, 100.93 (d, J = 3.1 Hz), 71.14 (dd, J = 34.4, 18.9 Hz), 41.43 (d, J = 2.5 Hz), 24.57. $^{19}$F NMR (377 MHz, Chloroform-d) δ -61.30 (d, J = 150.7 Hz), -83.90 (d, J = 150.8 Hz). HRMS-ESI (m/z): calcd for C$_{12}$H$_{14}$F$_2$N$_2$O, [M+H]$^+$: 241.1152, found, 241.1159.

**5,5-difluoro-N,N-dimethyl-4,5-dihydro-[2,2'-bifuran]-4-amine (2ad)**

Brown oil, (30.5 mg, 71% yield).

$^1$H NMR (400 MHz, Chloroform-d) δ 7.47 (s, 1H), 6.62 (s, 1H), 6.47 (s, 1H), 5.45 (s, 1H), 4.14 (dd, J = 14.6, 6.9 Hz, 1H), 2.47 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-d) δ 146.17 (d, J = 4.8 Hz), 144.08, 143.91, 131.15 (dd, J = 274.7, 272.5 Hz), 111.46, 110.05, 96.44 (d, J = 2.9 Hz),
70.78 (dd, J = 34.3, 18.8 Hz), 41.13 (d, J = 2.9 Hz). 19F NMR (377 MHz, Chloroform-d) δ -61.89 (d, J = 150.0 Hz), -83.91 (d, J = 149.9 Hz). HRMS-ESI (m/z): calcd for C10H11F2NO2, [M+H]+: 216.0836, found, 216.0852.

2,2-difluoro-N, N-dimethyl-5-(thiophen-2-yl)-2,3-dihydrofuran-3-amine (2ae) [1]

Dark yellow oil, (31.4 mg, 68% yield).

1H NMR (400 MHz, Chloroform-d) δ 7.36 (d, J = 5.0 Hz, 1H), 7.33 (d, J = 3.7 Hz, 1H), 7.05 (t, J = 4.1 Hz, 1H), 5.38 (s, 1H), 4.17 – 4.11 (m, 1H), 2.48 (s, 6H). 13C NMR (101 MHz, Chloroform-d) δ 149.54 (d, J = 4.3 Hz), 131.03 (dd, J = 274.8, 272.3 Hz), 130.92, 127.65, 127.25, 126.65, 96.54 (d, J = 3.1 Hz), 71.12 (dd, J = 34.5, 18.8 Hz), 41.12 (d, J = 2.7 Hz). 19F NMR (377 MHz, Chloroform-d) δ -61.59 (d, J = 150.1 Hz), -83.84 (d, J = 149.9 Hz). HRMS-ESI (m/z): calcd for C10H11F2NOS, [M+H]+: 232.0608, found, 232.0617.

2,2-difluoro-N, N-dimethyl-5-(thiophen-3-yl)-2,3-dihydrofuran-3-amine (2af)

Dark yellow oil, (32.8 mg, 71% yield).

1H NMR (400 MHz, Chloroform-d) δ 7.57 (s, 1H), 7.36 – 7.33 (m, 1H), 7.26 – 7.23 (m, 1H), 5.36 (s, 1H), 4.14 (dd, J = 14.5, 6.7 Hz, 1H), 2.48 (s, 6H). 13C NMR (101 MHz, Chloroform-d) δ 150.80 (d, J = 4.0 Hz), 131.11 (dd, J = 274.4, 271.6 Hz), 130.12, 126.75, 124.75, 124.20, 96.75 (d, J = 3.1 Hz), 70.96 (dd, J = 34.5, 19.0 Hz), 41.10 (d, J = 2.9 Hz). 19F NMR (377 MHz, Chloroform-d) δ -61.50 (d, J = 150.5 Hz), -83.91 (d, J = 150.0 Hz). HRMS-ESI (m/z): calcd for C10H11F2NOS, [M+H]+: 232.0608, found, 232.0617.

2-(4-(dimethylamino)-5,5-difluoro-4,5-dihydrofuran-2-yl)-9H-fluoren-9-one (2ag)

Light yellow solid, m.p. = 114-116 ºC (42.5 mg, 65% yield).

1H NMR (400 MHz, Chloroform-d) δ 7.85 (s, 1H), 7.69 (dd, J = 14.4, 7.6 Hz, 2H), 7.57 – 7.47 (m, 3H), 7.32 (t, J = 7.1 Hz, 1H), 5.63 (s, 1H), 4.17 (dd, J = 14.8, 7.2 Hz, 1H), 2.48 (s, 6H). 13C NMR (101 MHz, Chloroform-d) δ 192.95, 153.26 (d, J = 3.7 Hz), 145.29, 143.77, 135.01, 134.47, 134.39, 131.06 (dd, J = 274.6, 271.6 Hz), 131.33, 129.65, 129.04, 124.58, 121.32, 120.80, 120.48, 98.56 (d, J = 3.0 Hz), 71.08 (dd, J = 34.5, 19.0 Hz), 41.24 (d, J = 2.1 Hz). 19F NMR (377 MHz, Chloroform-d) δ -61.47 (d, J = 150.5 Hz), -83.59 (d, J = 150.0 Hz). HRMS-ESI (m/z): calcd for C19H15F2NO2, [M+H]+: 328.1149, found, 328.1139.
S16

Fe

O

N

F

Me

Me

2,2-difluoro-N, N-dimethyl-5-ferrocenyl-2,3-dihydrofuran-3-amine (2ah)

Dark purple solid, m.p. = 76-78 °C (53.9 mg, 81% yield).

\(^1\)H NMR (400 MHz, Chloroform-\(d\)) \(\delta\) 5.10 (s, 1H), 4.53 (d, \(J = 12.9\) Hz, 2H), 4.31 (s, 2H), 4.19 (s, 5H), 3.98 (d, \(J = 12.2\) Hz, 1H), 2.48 (s, 6H). \(^{13}\)C NMR (101 MHz, Chloroform-\(d\)) \(\delta\) 155.80 (d, \(J = 4.2\) Hz), 133.91 – 128.45 (m), 94.67, 72.43, 70.93 (dd, \(J = 34.0, 18.4\) Hz), 69.69, 66.63 (d, \(J = 7.9\) Hz), 41.04. \(^{19}\)F NMR (377 MHz, Chloroform-\(d\)) \(\delta\) -61.35 (d, \(J = 151.0\) Hz), -84.85 (d, \(J = 150.7\) Hz). HRMS-ESI (m/z): calcd for C\(_{16}\)H\(_{17}\)F\(_2\)FeNO, [M+H]\(^+\): 334.0706, found, 334.0671.

5-((1r,3R,5S)-adamantan-1-yl)-2,2-difluoro-N, N-dimethyl-2,3-dihydrofuran-3-amine (2ai)

Light yellow oil, (41.3 mg, 73% yield).

\(^1\)H NMR (400 MHz, Chloroform-\(d\)) \(\delta\) 4.73 (t, \(J = 2.4\) Hz, 1H), 3.86 (ddd, \(J = 15.1, 6.6, 2.4\) Hz, 1H), 2.40 (s, 6H), 2.01 (t, \(J = 3.2\) Hz, 3H), 1.77 (q, \(J = 12.9, 11.4\) Hz, 12H). \(^{13}\)C NMR (101 MHz, Chloroform-\(d\)) \(\delta\) 166.01 (d, \(J = 2.6\) Hz), 131.23 (dd, \(J = 272.9, 270.2\) Hz), 94.43 (d, \(J = 2.5\) Hz), 70.23 (dd, \(J = 35.1, 19.0\) Hz), 40.96 (d, \(J = 2.7\) Hz), 39.11, 36.60, 34.17, 27.75. \(^{19}\)F NMR (377 MHz, Chloroform-\(d\)) \(\delta\) -61.83 (d, \(J = 150.8\) Hz), -85.47 (d, \(J = 151.0\) Hz). HRMS-ESI (m/z): calcd for C\(_{16}\)H\(_{23}\)F\(_2\)NO, [M+H]\(^+\): 284.1826, found, 284.1886.

N, N-dibenzyl-2,2-difluoro-5-(p-tolyl)-2,3-dihydrofuran-3-amine (2aj)

Light yellow solid, m.p. = 83-85 °C (56.3 mg, 72% yield).

\(^1\)H NMR (400 MHz, Chloroform-\(d\)) \(\delta\) 7.43 (d, \(J = 8.0\) Hz, 2H), 7.40 – 7.21 (m, 10H), 7.16 (d, \(J = 8.0\) Hz, 2H), 5.43 (s, 1H), 4.36 (ddd, \(J = 14.6, 8.4, 2.2\) Hz, 1H), 3.97 – 3.72 (m, 4H), 2.34 (s, 3H). \(^{13}\)C NMR (101 MHz, Chloroform-\(d\)) \(\delta\) 154.54 (d, \(J = 3.7\) Hz), 129.25, 128.74, 128.38, 127.17, 125.52, 125.23, 97.38 (d, \(J = 3.4\) Hz), 66.10 (dd, \(J = 34.4, 19.2\) Hz), 54.38, 21.45. \(^{19}\)F NMR (377 MHz, Chloroform-\(d\)) \(\delta\) -61.98 (d, \(J = 150.8\) Hz), -85.47 (d, \(J = 151.0\) Hz). HRMS-ESI (m/z): calcd for C\(_{25}\)H\(_{23}\)F\(_2\)NO, [M+H]\(^+\): 392.1826, found, 392.1830.

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2,2-difluoro-N, N-dimethyl-3,4-dihydro-2H-indeno[1,2-b]furan-3-amine (2ak)

Dark yellow oil, (32.2 mg, 68% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) δ 7.39 (d, $J = 7.2$ Hz, 1H), 7.31 (d, $J = 7.1$ Hz, 1H), 7.26 (t, $J = 7.1$ Hz, 1H), 7.23 – 7.19 (m, 1H), 4.26 (dd, $J = 13.8$, 7.1 Hz, 1H), 3.31 (s, 2H), 2.41 (s, 6H).

$^{13}$C NMR (101 MHz, Chloroform-$d$) δ 159.34 (d, $J = 4.4$ Hz), 146.04, 136.28 (dd, $J = 285.4$, 282.5 Hz), 132.14, 126.83, 126.44, 124.97, 118.25, 117.39 (dd, $J = 3.8$, 1.7 Hz), 70.86 (dd, $J = 33.4$, 18.9 Hz), 41.00, 31.91.

$^{19}$F NMR (377 MHz, Chloroform-$d$) δ -58.28 (d, $J = 145.0$ Hz), -77.21 (d, $J = 145.1$ Hz). HRMS-ESI (m/z): calcd for C$_{13}$H$_{13}$F$_2$NO, [M+H]$^+$: 238.1043, found, 238.1038.

2,2-difluoro-N, N,4,4-tetramethyl-3,4-dihydro-2H-indeno[1,2-b]furan-3-amine (2al)

Dark yellow solid, m.p. = 128-130 °C (22.2 mg, 42% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) δ 7.40 – 7.34 (m, 1H), 7.33 – 7.26 (m, 3H), 4.24 (dd, $J = 14.1$, 7.4 Hz, 1H), 2.60 – 2.40 (m, 6H), 1.45 (s, 3H), 1.36 (s, 3H).

$^{19}$F NMR (377 MHz, Chloroform-$d$) δ -56.81 (d, $J = 144.1$ Hz), -76.82 (d, $J = 144.1$ Hz).

$^{13}$C NMR (101 MHz, Chloroform-$d$) δ 156.92, 156.42 (d, $J = 4.7$ Hz), 136.34 (t, $J = 286.1$ Hz), 130.21, 126.89, 126.77, 121.84, 118.34, 70.15 (dd, $J = 32.0$, 19.0 Hz), 44.14, 40.70, 24.70, 24.04. HRMS-ESI (m/z): calcd for C$_{13}$H$_{15}$F$_2$NO, [M+H]$^+$: 266.1356, found, 266.1349.

2,2-difluoro-N, N-dimethyl-2,3,4,5-tetrahydronaphtho[1,2-b]furan-3-amine (2am)

Dark yellow oil, (26.1 mg, 52% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) δ 7.32 (dd, $J = 5.9$, 3.0 Hz, 1H), 7.25 – 7.22 (m, 2H), 7.16 (m, 1H), 4.09 (dd, $J = 14.0$, 7.8 Hz, 1H), 2.99 (t, $J = 8.1$ Hz, 2H), 2.52 (s, 6H), 2.47 – 2.42 (m, 2H). $^{13}$C NMR (101 MHz, Chloroform-$d$) δ 149.46 (d, $J = 4.0$ Hz), 136.41, 132.57 (dd, $J = 277.7$, 276.0 Hz), 128.80, 127.72, 126.61, 125.65, 121.09, 110.14 (dd, $J = 3.4$, 1.3 Hz), 72.32 (dd, $J = 33.2$, 19.0 Hz), 40.49 (d, $J = 3.0$ Hz), 27.87, 20.35. $^{19}$F NMR (377 MHz, Chloroform-$d$) δ -59.83 (d, $J = 149.3$ Hz), -81.87 (d, $J = 149.8$ Hz). HRMS-ESI (m/z): calcd for C$_{14}$H$_{15}$F$_2$NO, [M+H]$^+$: 252.1200, found, 252.1234.

2,2-difluoro-N, N-dimethyl-3,4,5,6-tetrahydro-2H-benzo[6,7]cyclohepta[1,2-b]furan-3-amine (2an)

Light yellow oil, (23.8 mg, 45% yield).
$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 7.69 – 7.65 (m, 1H), 7.25 – 7.20 (m, 2H), 7.15 – 7.10 (m, 1H), 3.99 (dd, $J = 14.0, 7.3$ Hz, 1H), 2.92 – 2.80 (m, 2H), 2.53 (s, 6H), 2.38 (dt, $J = 18.2, 6.5$ Hz, 2H), 2.01 – 1.88 (m, 2H). $^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 146.49 (d, $J = 3.0$ Hz), 141.56, 130.58 (t, $J = 271.3$ Hz), 129.25, 128.88, 127.91, 126.82, 126.22, 115.10, 74.33 (dd, $J = 33.4, 19.2$ Hz), 40.08 (d, $J = 3.0$ Hz), 35.90, 27.67, 24.57.

$^{19}$F NMR (377 MHz, Chloroform-$d$) $\delta$ -59.40 (d, $J = 151.5$ Hz), -84.06 (d, $J = 153.5$ Hz). HRMS-ESI (m/z): calcd for C$_{15}$H$_{17}$F$_2$NO, [M+H]$^+$: 266.1356, found, 266.1384.

2,2-difluoro-$N$-dimethyl-4,5-diphenyl-2,3-dihydrofuran-3-amine (2ao)

Light yellow oil, (43.9 mg, 73% yield).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 7.45 (d, $J = 7.7$ Hz, 2H), 7.31 (m, 8H), 4.35 (dd, $J = 13.6, 5.7$ Hz, 1H), 2.54 (s, 6H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ (ppm) 148.90, 132.83, 130.24 (dd, $J = 275.1, 272.7$ Hz), 129.70, 128.93, 128.68, 128.61, 128.29, 127.77, 127.71, 113.26, 73.64 (dd, $J = 33.9, 18.9$ Hz), 40.14.

$^{19}$F NMR (377 MHz, CDCl$_3$) $\delta$ (ppm) -59.95 (d, $J = 149.7$ Hz), -85.95 (d, $J = 149.7$ Hz). HRMS-ESI (m/z): calcd for C$_{18}$H$_{17}$F$_2$NO, [M+H]$^+$: 302.1356, found, 302.1343.

2,2-difluoro-5-(4-methoxyphenyl)-$N$-dimethyl-4-phenyl-2,3-dihydrofuran-3-amine (2ap)

Light yellow oil, (53.6 mg, 81% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 7.42 – 7.36 (m, 4H), 7.26 (d, $J = 10.3$ Hz, 3H), 6.78 (d, $J = 8.5$ Hz, 2H), 4.31 (dd, $J = 13.6, 5.6$ Hz, 1H), 3.78 (s, 3H), 2.53 (s, 6H).

$^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 160.58, 148.85 (d, $J = 2.9$ Hz), 133.21, 130.27 (dd, $J = 275.2, 272.3$ Hz), 129.30, 128.67, 128.57, 127.48, 121.36, 113.70, 111.45, 73.65 (dd, $J = 33.7, 18.9$ Hz), 55.28, 40.11.

$^{19}$F NMR (377 MHz, Chloroform-$d$) $\delta$ -59.92 (d, $J = 149.6$ Hz), -86.07 (d, $J = 149.6$ Hz). HRMS-ESI (m/z): calcd for C$_{19}$H$_{19}$F$_2$NO$_2$, [M+H]$^+$: 332.1462, found, 332.1476.

5-(4-chlorophenyl)-2,2-difluoro-$N$-dimethyl-4-phenyl-2,3-dihydrofuran-3-amine (2aq)

Light yellow oil, (44.2 mg, 66% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 7.38 (d, $J = 8.0$ Hz, 2H), 7.35 – 7.28 (m, 5H), 7.23 (d, $J = 7.8$ Hz, 2H), 4.33 (dd, $J = 13.7, 5.9$ Hz, 1H), 2.52 (s, 6H). $^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 147.72 (d, $J = 3.1$ Hz), 135.59, 132.54, 130.15 (dd, $J = 274.8, 272.3$ Hz), 129.04, 128.75, 128.65, 128.60, 127.96, 127.36, 113.98, 73.72 (dd, $J = 33.7, 18.9$ Hz), 40.18.

$^{19}$F NMR (377 MHz, Chloroform-$d$) $\delta$ -59.92 (d, $J = 149.6$ Hz), -86.07 (d, $J = 149.6$ Hz). HRMS-ESI (m/z): calcd for C$_{19}$H$_{19}$F$_2$NO$_2$, [M+H]$^+$: 332.1462, found, 332.1476.
Chloroform-d) δ -60.02 (d, J = 149.5 Hz), -85.77 (d, J = 149.5 Hz). HRMS-ESI (m/z): calcd for C\textsubscript{18}H\textsubscript{16}ClF\textsubscript{2}NO, [M+H]\textsuperscript{+}: 336.0967, found, 336.0971.

2,2-difluoro-5-((R)-3,5,5,6,7,8-hexamethyl-5,6,7,8-tetrahydronaphthalen-2-yl)-N,N-dimethyl-2,3-dihydrofuran-3-amine (2ar)
Yellow solid, m.p. = 71-73 °C (39.9 mg, 55% yield).
\textsuperscript{1}H NMR (400 MHz, Chloroform-d) δ 7.48 (s, 1H), 7.20 (s, 1H), 5.30 (t, J = 2.3 Hz, 1H), 4.14 (ddt, J = 14.8, 7.3, 1.6 Hz, 1H), 2.50 (s, 6H), 2.41 (s, 3H), 1.87 (ddd, J = 12.9, 6.7, 2.5 Hz, 1H), 1.64 (d, J = 13.3 Hz, 1H), 1.40 – 1.36 (m, 1H), 1.33 – 1.29 (m, 6H), 1.26 (d, J = 2.0 Hz, 3H), 1.06 (s, 3H), 0.99 (d, J = 6.8 Hz, 3H). \textsuperscript{13}C NMR (101 MHz, Chloroform-d) 154.71 (d, J = 3.6 Hz), 147.94, 142.63, 133.49 – 128.04 (m), 133.42, 129.76, 126.28, 125.35, 100.93, 71.18 (dd, J = 34.7, 18.9 Hz), 43.57, 41.20, 37.73, 34.46, 34.11, 32.38 (d, J = 2.4 Hz), 31.97, 28.47, 24.84, 21.44, 16.83. \textsuperscript{19}F NMR (377 MHz, Chloroform-d) δ -61.54 (dd, J = 151.5, 10.4 Hz), -84.94 (dd, J = 151.5, 16.8 Hz). HRMS-ESI (m/z): calcd for C\textsubscript{22}H\textsubscript{31}F\textsubscript{2}NO, [M+H]\textsuperscript{+}: 364.2452, found, 364.2417.

(8S,9S,10R,13S,14S)-17-(4-(dimethylamino)-5,5-difluoro-4,5-dihydrofuran-2-yl)-10,13-dimethyl-1,2,6,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-3H-cyclopenta[a]phenanthren-3-one (2as)
Yellow solid, m.p. = 62-64 °C (51.9 mg, 62% yield).
\textsuperscript{1}H NMR (400 MHz, Chloroform-d) δ 5.73 (s, 1H), 4.88 (s, 1H), 4.02 – 3.83 (m, 1H), 2.43 (d, J = 6.2 Hz, 6H), 2.40 – 2.33 (m, 2H), 2.32 – 2.19 (m, 2H), 2.05 (tt, J = 13.0, 3.4 Hz, 2H), 1.88 (dd, J = 13.0, 9.3, 5.9 Hz, 2H), 1.75 (dddd, J = 23.0, 18.4, 11.0, 5.7 Hz, 3H), 1.62 – 1.49 (m, 2H), 1.47 – 1.38 (m, 1H), 1.27 (ddd, J = 13.3, 8.3, 4.0 Hz, 3H), 1.19 (s, 3H), 1.13 – 0.92 (m, 3H), 0.70 (d, J = 27.8 Hz, 3H). \textsuperscript{13}C NMR (101 MHz, Chloroform-d) δ 199.57, 171.12, 159.28, 123.90, 98.80 (d, J = 2.7 Hz), 98.63 (d, J = 2.2 Hz), 70.58 (m), 55.13, 55.10, 53.78, 53.76, 49.22, 49.12, 43.67, 43.64, 41.13, 40.93, 38.63, 38.05, 37.97, 35.80, 35.70, 33.95, 32.81, 31.92, 24.32, 23.85, 20.86, 17.37, 13.13, 12.91. \textsuperscript{19}F NMR (377 MHz, Chloroform-d) δ -61.10 (dd, J = 151.5, 10.4 Hz), -84.94 (dd, J = 151.5, 16.8 Hz). HRMS-ESI (m/z): calcd for C\textsubscript{25}H\textsubscript{35}F\textsubscript{2}NO\textsubscript{2}, [M+H]\textsuperscript{+}: 420.2714, found, 420.2693.
(8R,9S,13S,14S)-3-((4-(4-(dimethylamino)-3,3-difluoro-2,3-dihydrofuran-2-yl)benzyl)oxy)-13-methyl-6,7,8,9,11,12,13,14,15,16-decahydro-17H-cyclopenta[a]phenanthren-17-one (2at)

Yellow solid, m.p. = 144-146 °C (45.6 mg, 45% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 7.61 (d, $J$ = 8.0 Hz, 2H), 7.45 (d, $J$ = 8.0 Hz, 2H), 7.20 (d, $J$ = 8.6 Hz, 1H), 6.79 – 6.74 (m, 1H), 6.71 (s, 1H), 5.55 (s, 1H), 5.06 (s, 2H), 4.15 (ddd, $J$ = 15.0, 7.3, 2.7 Hz, 1H), 2.89 (dd, $J$ = 10.4, 4.5 Hz, 2H), 2.42 – 2.35 (m, 1H), 2.24 (t, $J$ = 10.3 Hz, 1H), 2.17 – 1.94 (m, 4H), 1.61 – 1.38 (m, 6H), 1.27 (d, $J$ = 12.1 Hz, 1H), 0.90 (s, 3H).

$^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 220.96, 156.58, 154.08 (d, $J$ = 3.7 Hz), 139.31, 137.90, 132.55, 131.17 (dd, $J$ = 274.1, 271.4 Hz), 127.71, 127.39, 126.42, 125.56, 114.93, 112.36, 97.51 (d, $J$ = 3.0 Hz), 71.03 (dd, $J$ = 34.5, 19.0 Hz), 69.39, 50.41, 48.02, 43.99, 41.18 (d, $J$ = 3.0 Hz), 38.33, 35.89, 29.67, 26.53, 25.92, 21.60, 13.87.

$^{19}$F NMR (377 MHz, Chloroform-$d$) $\delta$ -61.27 (d, $J$ = 150.9 Hz), -83.79 (d, $J$ = 150.7 Hz). HRMS-ESI (m/z): calcd for C$_{31}$H$_{35}$F$_2$NO$_3$, [M+H]$^+$: 508.2663, found, 508.2688.

2-(4-(dimethylamino)-5,5-difluoro-4,5-dihydrofuran-2-yl)phenyl 4-methylbenzoate (4b)

Yellow oil, (30.8 mg, 43% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 8.10 (d, $J$ = 8.2 Hz, 2H), 7.79 – 7.71 (m, 1H), 7.49 – 7.42 (m, 1H), 7.40 – 7.30 (m, 3H), 7.28 – 7.20 (m, 1H), 5.65 – 5.51 (m, 1H), 4.04 (ddd, $J$ = 15.0, 7.6, 2.9 Hz, 1H), 2.46 (s, 3H), 2.35 (s, 6H).

$^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 164.57, 150.13 (d, $J$ = 3.8 Hz), 148.57, 144.96, 133.21 – 127.68 (m), 130.64, 130.27, 129.57, 128.24, 126.25, 126.16, 123.50, 121.65, 102.48 (d, $J$ = 271.4 Hz), 71.05 (dd, $J$ = 34.5, 18.9 Hz), 40.98, 21.80. $^{19}$F NMR (377 MHz, Chloroform-$d$) $\delta$ -61.27 (d, $J$ = 150.9 Hz), -83.79 (d, $J$ = 150.7 Hz). HRMS-ESI (m/z): calcd for C$_{20}$H$_{19}$F$_2$NO$_3$, [M+H]$^+$: 360.1411, found, 360.1436.

3-(4-methylbenzoyl)-4H-chromen-4-one (5b)

White solid, m.p. = 126-128 °C (22.7 mg, 37% yield).

$^1$H NMR (400 MHz, Chloroform-$d$) $\delta$ 8.33 – 8.23 (m, 2H), 7.80 – 7.75 (m, 2H), 7.74 – 7.69 (m, 1H), 7.56 – 7.51 (m, 1H), 7.50 – 7.44 (m, 1H), 7.28 – 7.23 (m, 2H), 2.42 (s, 3H).

$^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 191.40, 174.76, 158.35, 156.08, 144.52, 134.64, 134.34, 129.78, 129.16,
126.49, 126.06, 125.39, 125.00, 118.30, 21.80.

benzene-1,3,5-triyltris(p-tolylmethanone) (6)\textsuperscript{[3]}
Yellow solid, m.p. = 152-154 °C.
\textsuperscript{1}H NMR (400 MHz, Chloroform-\textit{d}) \(\delta\) 8.34 (s, 3H), 7.76 (d, \(J = 8.1\) Hz, 6H), 7.30 (d, \(J = 8.1\) Hz, 6H), 2.44 (s, 9H). \textsuperscript{13}C NMR (101 MHz, Chloroform-\textit{d}) \(\delta\) 194.76, 144.24, 138.45, 133.86, 133.71, 130.35, 129.35, 21.75.

References

NMR Spectra for All Compounds

$^1$H NMR of compound 2a

$^{13}$C NMR of compound 2a
$^{19}$F NMR of compound 2a

$^1$H NMR of compound 2b
$^{13}$C NMR of compound 2b

$^{19}$F NMR of compound 2b
$^1$H NMR of compound 2c

$^{13}$C NMR of compound 2c
$^{19}$F NMR of compound 2c

$^1$H NMR of compound 2d
$^{13}$C NMR of compound 2d

$^{19}$F NMR of compound 2d
\( ^1H \) NMR of compound 2e

\( ^13C \) NMR of compound 2e
$^{19}$F NMR of compound 2e

$^1$H NMR of compound 2f
$^{13}$C NMR of compound 2f

$^{19}$F NMR of compound 2f
$^1$H NMR of compound 2g

$^{13}$C NMR of compound 2g
$^{19}$F NMR of compound 2g

$^{1}$H NMR of compound 2h
$^{13}$C NMR of compound 2h

$^{19}$F NMR of compound 2h
$^1$H NMR of compound 2i

$^{13}$C NMR of compound 2i
$^{19}$F NMR of compound 2i

$^{19}$F NMR (CDCl$_3$, 377 MHz)

$^1$H NMR of compound 2j

$^1$H NMR (CDCl$_3$, 400 MHz)
$^{13}$C NMR of compound 2j

$^{19}$F NMR of compound 2j
\(^1\)H NMR of compound 2k

\(^{13}\)C NMR of compound 2k
$^{19}$F NMR of compound 2k

$^{1}$H NMR of compound 2l
$^{13}$C NMR of compound 2l

$^{19}$F NMR of compound 2l
\(^1\)H NMR of compound 2m

\[^{13}\text{C}\) NMR of compound 2m
$^{19}$F NMR of compound 2m

$^1$H NMR of compound 2n
$^{13}$C NMR of compound 2n

$^{19}$F NMR of compound 2n
**$^1$H NMR of compound 2o**

![1H NMR spectrum](image)

**$^{13}$C NMR of compound 2o**

![13C NMR spectrum](image)
$^{19}$F NMR of compound 2o

$^{1}$H NMR of compound 2p
$^{13}$C NMR of compound 2p

$^{19}$F NMR of compound 2p
$^{19}$F NMR of compound 2q

$^{1}$H NMR of compound 2r
**13C NMR of compound 2r**

![13C NMR spectrum of compound 2r](image)

**19F NMR of compound 2r**

![19F NMR spectrum of compound 2r](image)
$^1$H NMR of compound 2s

$^{13}$C NMR of compound 2s
$^{19}$F NMR of compound 2s

$^{1}$H NMR of compound 2t
$^{13}$C NMR of compound 2t

$^{19}$F NMR of compound 2t
$^1$H NMR of compound 2u

$^{13}$C NMR of compound 2u
\[^{19}F\] NMR of compound 2u

\[^{1}H\] NMR of compound 2v
$^{13}$C NMR of compound 2v

$^{19}$F NMR of compound 2v
$^1$H NMR of compound 2w

$^{13}$C NMR of compound 2w
$^{19}$F NMR of compound 2w

$^{1}$H NMR of compound 2x
$^{13}$C NMR of compound 2x

$^{19}$F NMR of compound 2x
$^1$H NMR of compound 2y

$^{13}$C NMR of compound 2y
$^{19}\text{F NMR of compound 2y}$

$^{1}\text{H NMR of compound 2z}$
$^{13}$C NMR of compound $2z$

$^{19}$F NMR of compound $2z$
$^1$H NMR of compound 2aa

$^{13}$C NMR of compound 2aa
$^{19}$F NMR of compound 2aa

$^1$H NMR of compound 2ab
$^{13}$C NMR of compound 2ab

$^{19}$F NMR of compound 2ab
1H NMR of compound 2ac

13C NMR of compound 2ac
$^{19}$F NMR of compound 2ac

$^{1}$H NMR of compound 2ad
$^{13}$C NMR of compound 2ad

$^{19}$F NMR of compound 2ad
$^1$H NMR of compound 2ae

$^{13}$C NMR of compound 2ae
$^{19}$F NMR of compound 2ae

$^{1}$H NMR of compound 2af
$^{13}$C NMR of compound 2af

$^{19}$F NMR of compound 2af
$^1$H NMR of compound 2ag

$^{13}$C NMR of compound 2ag
$^{19}$F NMR of compound 2ag

$^{1}$H NMR of compound 2ah
$^{13}$C NMR of compound 2ah

$^{19}$F NMR of compound 2ah
$^1$H NMR of compound 2ai

$^{13}$C NMR of compound 2ai
$^{19}$F NMR of compound 2ai

$^1$H NMR of compound 2aj
$^{13}$C NMR of compound 2aj

$^{19}$F NMR of compound 2aj
$^1$H NMR of compound 2ak

$^{13}$C NMR of compound 2ak
$^{19}$F NMR of compound 2ak

$^1$H NMR of compound 2al
$^{13}$C NMR of compound 2al

$^{19}$F NMR of compound 2al
$^1$H NMR of compound 2am

$^{13}$C NMR of compound 2am
$^{19}$F NMR of compound 2am

$^{1}$H NMR of compound 2an
$^{13}$C NMR of compound 2an

$^{19}$F NMR of compound 2an
$^1$H NMR of compound 2ao

$^{13}$C NMR of compound 2ao
$^{19}$F NMR of compound 2ao

$^1$H NMR of compound 2ap
$^{13}\text{C NMR of compound 2ap}$

$^{19}\text{F NMR of compound 2ap}$
$^1$H NMR of compound 2aq

$^{13}$C NMR of compound 2aq
$^{19}$F NMR of compound 2aq

$^1$H NMR of compound 2ar
$^{13}$C NMR of compound 2ar

$^{19}$F NMR of compound 2ar
\(^1\)H NMR of compound 2as

\(^{13}\)C NMR of compound 2as
$^{19}$F NMR of compound 2as

$^1$H NMR of compound 2at
$^{13}$C NMR of compound 2a

$^{13}$C NMR (CDCl$_3$, 101 MHz)

$^{19}$F NMR of compound 2a

$^{19}$F NMR (CDCl$_3$, 377 MHz)
$^1$H NMR of compound 4b

$^{13}$C NMR of compound 4b
$^{19}$F NMR of compound 4b

$^1$H NMR of compound 5b
$^{13}$C NMR of compound 5b

$^{1}$H NMR of compound 6
$^{13}$C NMR of compound 6