General considerations:

All reactions were carried out in air. All reagents and solvents were used as purchased. NMR spectra were recorded on Varian Gemini spectrometer and reported in ppm: $^1$H NMR spectra were recorded at 400 MHz and are referenced to TMS, $^{13}$C NMR spectra were recorded at 100 MHz, $^{19}$F NMR spectra were recorded at 376.5 MHz. Elemental analysis were performed at London Metropolitan University Service.

Complex [Au(IPr)(OH)] was prepared according to literature procedures.$^1$

Solution Calorimetry measurements for reaction between 1 and 2a: The mixing vessels of the Setaram C-80 were cleaned, dried in an oven maintained at 120 °C, and then taken into the glovebox. A 15-20 mg sample of 1 was weighed out accurately into the inner vessel. Four milliliters of a solution of the carboxylic acid (3 fold excess) was added to the outer cell compartment. The remainder of a cell was assembled, removed from the glovebox and inserted in the calorimeter. The reference vessel was loaded in an identical fashion with the exception that no organometallic complex was added to the inner vessel. After the calorimeter has reached thermal equilibrium at 30 °C (approximately 3 h), the calorimeter was inverted, thereby allowing the reactants to mix. After the reaction had reached completion and the calorimeter had once again reached thermal equilibrium (approximately 3 h), the
vessels were removed from the calorimeter, taken into the glovebox, opened, and analyzed using $^1$HNMR spectroscopy. The enthalpy of reaction (-9.4(5)) represents the average of 3-5 individual calorimetric determinations with all species in solution.

**General procedure for stoichiometric decarboxylation:** A scintillation vial was charged with $[(	ext{IPr})	ext{AuOH}]$ (20 mg, 0.033 mmol) and the carboxylic acid (0.033 mmol) in toluene (0.4 mL). The reaction mixture was stirred at 110°C and monitored by $^1$H NMR. Upon completion, the product mixture was concentrated under reduced pressure to afford the clean desired product without further purification.

**Figure S1.**

Figure S1. $^1$H NMR experiments following the evolution of 2a to 4 to 3a.
Product Characterization data:

\([\text{N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl]2,6-dimethoxyphenyl)}\text{gold(I)}}\) (3a)

\[
\begin{align*}
\text{OMe} & \quad \text{Au(Pr)} \\
\text{OMe} & \\
\end{align*}
\]

1H NMR (CDCl\(_3\), 400 MHz): 7.48 (t, 2H, \(J = 8\) Hz), 7.29 (d, 4H, \(J = 7.6\) Hz), 7.17 (s, 2H), 6.81 (t, 1H, \(J = 7.8\) Hz), 6.42 (d, 2H, \(J = 8\) Hz), 3.30 (s, 6H), 2.69 (sept, 1H, \(J = 6.8\) Hz), 1.39 (d, 12H, \(J = 6.8\) Hz), 1.24 (d, 12H, \(J = 6.8\) Hz).

13C NMR (CDCl\(_3\), 100 MHz): 196.5, 168.2, 146.1, 143.9, 135, 130.1, 126.1, 124, 122.7, 107.6, 56.9, 24.4, 24.2.


\([\text{N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl]2-acetylphenyl})\text{gold(I)}}\) (3b)

\[
\begin{align*}
\text{O} & \quad \text{Au(Pr)} \\
\end{align*}
\]

1H NMR (CDCl\(_3\), 400 MHz): 7.70-7.68 (m, 1H), 7.50 (t, 2H, \(J = 8\) Hz), 7.30 (d, 4H, \(J = 7.6\) Hz), 7.28-7.25 (m, 2H), 7.21 (s, 2H), 6.81 (t, 1H, \(J = 7.8\) Hz), 7.17-7.14 (m, 1H), 2.57 (sept, 1H, \(J = 6.8\) Hz), 2.13 (s, 3H), 1.39 (d, 12H, \(J = 6.8\) Hz), 1.23 (d, 12H, \(J = 6.8\) Hz).

13C NMR (CDCl\(_3\), 100 MHz): 205.1, 171.2, 168.2, 145.8, 142.8, 135.7, 134.1, 130.8, 129.8, 129.4, 125.9, 124.4, 123.3, 30.3, 29.0, 24.5, 24.2.

Anal. Calcd for C\(_{35}\)H\(_{43}\)AuN\(_2\)O: C, 59.65; H, 6.15; N, 3.98. Found: C, 59.54; H, 6.20; N, 3.89.

\([\text{N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl]2-methoxyphenyl})\text{gold(I)}}\) (3c)

\[
\begin{align*}
\text{OMe} & \quad \text{Au(Pr)} \\
\end{align*}
\]

1H NMR (CDCl\(_3\), 400 MHz): 7.47 (t, 2H, \(J = 8\) Hz), 7.28 (d, 4H, \(J = 7.6\) Hz), 7.16 (s, 2H), 6.85 (td, 1H, \(J = 7.6, 1.6\) Hz), 7.02 (dd, 1H, \(J = 7, 1.8\) Hz), 6.66-6.72 (m, 2H), 3.38 (s, 3H), 2.68 (sept, 1H, \(J = 6.8\) Hz), 1.40 (d, 12H, \(J = 6.8\) Hz), 1.24 (d, 12H, \(J = 6.8\) Hz).

13C NMR (CDCl\(_3\), 100 MHz): 196.7, 166.7, 157.0, 145.9, 141.1, 134.8, 130.2, 125.3, 124.0, 122.8, 120.6, 113.2, 56.9, 28.9, 24.5, 24.1.

[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl](2-dimethylaminophenyl)gold(I) (3d)

\[
\begin{align*}
\text{H NMR (CDCl}_3, 400 \text{ MHz):} & \quad \delta 7.49 (t, 2H, J = 7.8 \text{ Hz}), 7.30 (d, 4H, J = 8 \text{ Hz}), 7.17 (s, 2H), 7.00 (dd, 1H, J = 6.8, 1.6 \text{ Hz}), 6.82 (m, 1H), 6.71 (dd, 1H, J = 8, 1.2 \text{ Hz}), 6.59 (td, 1H, J = 7.2, 1.2 \text{ Hz}), 2.70 (sept, 1H, J = 6.8 \text{ Hz}), 2.49 (s, 6H), 1.38 (d, 12H, J = 6.8 \text{ Hz}), 1.23 (d, 12H, J = 6.8 \text{ Hz}). \\
\text{13C NMR (CDCl}_3, 100 \text{ MHz):} & \quad \delta 196.8, 162.3, 161.5, 145.9, 141.0, 135.0, 130.2, 124.9, 124.0, 122.8, 119.7, 117.0, 45.2, 28.9, 24.4, 24.3. \\
\text{Anal. Calcd for C}_{35}\text{H}_{46}\text{AuN}_3:} & \quad \text{C, 59.57; H, 6.57; N, 5.95. Found: C, 59.70; H, 6.20; N, 5.88.}
\end{align*}
\]

[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl](2,6-difluorophenyl)gold(I) (3e)

\[
\begin{align*}
\text{H NMR (CDCl}_3, 400 \text{ MHz):} & \quad \delta 7.48 (t, 2H, J = 8 \text{ Hz}), 7.29 (d, 4H, J = 7.6 \text{ Hz}), 7.18 (s, 2H), 6.80 (q, 1H, J = 8 \text{ Hz}), 6.59 (d, 1H, J = 5.6 \text{ Hz}), 6.57 (d, 1H, J = 5.6 \text{ Hz}), 2.66 (sept, 1H, J = 6.8 \text{ Hz}), 1.40 (d, 12H, J = 6.8 \text{ Hz}), 1.23 (d, 12H, J = 6.8 \text{ Hz}). \\
\text{13C NMR (CDCl}_3, 100 \text{ MHz):} & \quad \delta 194.3, 170.4 (d, J = 24.8 \text{ Hz}), 168.2 (d, J = 24.5 \text{ Hz}), 145.9, 143.9, 134.5, 130.4, 126.3 (t, J = 8.3 \text{ Hz}), 124.1, 122.9, 109.0 (dd, J = 30.7 \text{ Hz}, J = 3 \text{ Hz }, 29, 24.5, 24.2. \\
\text{19F NMR (CDCl}_3, 376 \text{ MHz):} & \quad \delta -87.66 (t, 2F, J = 6.2 \text{ Hz}) \\
\text{Anal. Calcd for C}_{33}\text{H}_{39}\text{AuF}_2\text{N}_2:} & \quad \text{C, 56.73; H, 5.63; N, 4.01. Found: C, 59.68; H, 5.51; N, 3.99.}
\end{align*}
\]

[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl](2-fluorophenyl)gold(I) (3f)

\[
\begin{align*}
\text{H NMR (CDCl}_3, 400 \text{ MHz):} & \quad \delta 7.47 (t, 2H, J = 8 \text{ Hz}), 7.28 (d, 4H, J = 7.6 \text{ Hz}), 7.16 (s, 2H), 7.08-7.05 (m, 1H), 6.89-6.81 (m, 2H), 6.76-6.73 (m, 1H), 2.67 (sept, 1H, J = 6.8 \text{ Hz}), 1.41 (d, 12H, J = 6.8 \text{ Hz}), 1.25 (d, 12H, J = 6.8 \text{ Hz}). \\
\text{13C NMR (CDCl}_3, 100 \text{ MHz):} & \quad \delta 195.7, 170.4, 167.3, 152.8, 152.1, 145.9, 141.3, 141.1, 134.6, 130.3, 125.5 (d, J = 38 \text{ Hz}), 124.1, 122.9, 122.7, 113.3, 112.9, 29.0, 24.6, 24.1. \\
\text{19F NMR (CDCl}_3, 376 \text{ MHz):} & \quad \delta -89.75 (s, 1F) \\
\text{Anal. Calcd for C}_{33}\text{H}_{40}\text{AuN}_2\text{F:} & \quad \text{C, 58.23; H, 5.92; N, 4.12. Found: C, 58.35; H, 6.03; N,}
\end{align*}
\]
N, 3.99.

$[^N,N$-Bis(2,6-diisopropylphenyl)imidazol-2-yl](2,3,4,5,6-pentafluorophenyl)gold(I) (3g)

![Chemical structure of 3g](image)

$^1$H NMR (CDCl$_3$, 400 MHz): \(\delta\) 7.49 (t, 2H, \(J = 7.8\) Hz), 7.29 (d, 4H, \(J = 8\) Hz), 7.20 (s, 2H), 2.62 (sept, 1H, \(J = 6.8\) Hz), 1.36 (d, 12H, \(J = 6.8\) Hz), 1.24 (d, 12H, \(J = 6.8\) Hz).

$^{13}$C NMR (CDCl$_3$, 100 MHz): \(\delta\) 192.1, 145.9, 134.2, 130.6, 129.2, 128.7, 128.4, 124.2, 123.1, 122.8, 119.7, 117.0, 45.2, 29.0, 24.5, 24.2.

$^{19}$F NMR (CDCl$_3$, 376 MHz): \(\delta\) -164.4 (t, 2F, \(J = 27.1\) Hz), -161.7 (t, 1F, \(J = 26.3\) Hz), -116.6 (d, 2F, \(J = 27.1\) Hz)

Anal. Calcd for C$_{33}$H$_{36}$AuF$_5$N$_2$: C, 52.66; H, 4.82; N, 3.72. Found: C, 52.70; H, 4.60; N, 3.62.

$[^N,N$-Bis(2,6-diisopropylphenyl)imidazol-2-yl](2-cyanophenyl)gold(I) (3h)

![Chemical structure of 3h](image)

$^1$H NMR (CDCl$_3$, 400 MHz): \(\delta\) 7.53-7.47 (m, 4H), 7.42-7.39 (m, 4H), 7.30 (d, 4H, \(J = 7.6\) Hz), 7.22 (s, 2H), 2.61 (sept, 1H, \(J = 6.8\) Hz), 1.44 (d, 12H, \(J = 6.8\) Hz), 1.25 (d, 12H, \(J = 6.8\) Hz).

$^{13}$C NMR (CDCl$_3$, 100 MHz): \(\delta\) 178.3, 177.4, 145.9, 136.4, 134.1, 131.9, 130.8, 129.2, 124.3, 123.2, 121.5, 29.1, 24.6, 24.2.

Anal. Calcd for C$_{34}$H$_{40}$AuN$_3$: C, 59.38; H, 5.86; N, 6.11. Found: C, 59.39; H, 5.72; N, 6.00.

$[^N,N$-Bis(2,6-diisopropylphenyl)imidazol-2-yl](2-nitrophenyl)gold(I) (3i)

![Chemical structure of 3i](image)

**Synthesis from boronic acid:** [Au(IPr)(OH)] (20 mg, 0.033 mmol) and 2-nitrophenylboronic acid (5.8 mg, 0.035 mmol) were charged in a vial containing benzene (0.5 mL). The reaction was stirred at room temperature overnight. The solution was filtered through Celite®, the solvent was removed from the filtrate under vacuum and pentane (6 mL) was added. The resulting precipitate was collected on a frit, washed with pentane (3 x 3 mL) and dried under vacuum to afford **2i** as a microcrystalline white solid (16.9 mg, 74%).
**1H NMR (CDCl₃, 400 MHz):** δ 7.73 (d, 1H, J = 8 Hz), 7.49 (t, 2H, J = 8 Hz), 7.30 (d, 1H, J = 8 Hz), 7.18-7.16 (m, 4H), 6.96-6.91 (m, 1H), 2.67 (sept, 1H, J = 6.8 Hz), 1.39 (d, 12H, J = 6.8 Hz), 1.24 (d, 12H, J = 6.8 Hz).

**13C NMR (CDCl₃, 100 MHz):** δ 193.2, 164.6, 158.8, 145.9, 141.7, 134.6, 130.9, 130.4, 129.2, 128.4, 125.4, 124.3, 124.1, 123.0, 122.9, 29.0, 24.5, 24.2.

**Anal. Calcd for C₃₃H₄₀AuN₃O₂:** C, 56.01; H, 5.70; N, 5.94. Found: C, 56.14; H, 5.83; N, 5.81.

**[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl](2-formylphenyl)gold(I) (3j)**

![Chemical Structure Image]

**Synthesis from boronic acid:** [Au(IPr)(OH)] (20 mg, 0.033 mmol) and (2-formylphenyl)boronic acid (5.2 mg, 0.035 mmol) were charged in a vial containing benzene (0.5 mL). The reaction was stirred at room temperature overnight. The solution was filtered through Celite®, the solvent was removed from the filtrate under vacuum and pentane (6 mL) was added. The resulting precipitate was collected on a frit, washed with pentane (3 x 3 mL) and dried under vacuum to afford 2j as a microcrystalline white solid (16.2 mg, 71%).

**1H NMR (CDCl₃, 400 MHz):** δ 9.63 (sd, 1H, J = 0.8 Hz), 7.75 (d, 1H, J = 8 Hz), 7.53 (t, 2H, J = 7.8 Hz), 7.32 (d, 4H, J = 8 Hz), 7.25 (d, 1H, J = 7.2 Hz), 7.21 (s, 2H), 7.18 (td, 1H, J = 7.2, 1.6 Hz), 6.98 (t, 1H, J = 7.8 Hz), 2.67 (sept, 1H, J = 6.8 Hz), 1.36 (d, 12H, J = 6.8 Hz), 1.25 (d, 12H, J = 6.8 Hz).

**13C NMR (CDCl₃, 100 MHz):** δ 199.5, 196.5, 180.0, 146.0, 145.9, 141.2, 134.5, 131.1, 130.6, 126.1, 124.4, 124.2, 123.1, 29.0, 24.5, 24.2.

**Anal. Calcd for C₃₄H₄₁AuN₂O:** C, 59.13; H, 5.98; N, 4.06. Found: C, 59.22; H, 5.93; N, 3.93.

**[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl]((E)-styryl)gold(I) (3k)**

![Chemical Structure Image]

**1H NMR (CDCl₃, 400 MHz):** δ 7.49 (t, 2H, J = 8 Hz), 7.40 (d, 1H, J = 19.6 Hz), 7.30 (d, 4H, J = 7.6 Hz), 7.20-7.18 (d, 2H, J = 8.4 Hz), 7.13-7.09 (m, 4H), 6.95 (tdt, 1H, J = 7.2 Hz), 6.32 (d, 1H, J = 19.2 Hz), 2.66 (sept, 1H, J = 6.8 Hz), 1.40 (d, 12H, J = 6.8 Hz), 1.23 (d, 12H, J = 6.8 Hz).

**13C NMR (CDCl₃, 100 MHz):** δ 197.9, 158.6, 145.9, 143.1, 141.2, 134.8, 130.3, 128.0, 125.3, 125.1, 124.1, 122.9, 28.9, 24.6, 24.1.


**[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl]((4-methoxyphenyl)gold(I) (3l)**

![Chemical Structure Image]
Synthesis from boronic acid: [Au(IPr)(OH)] (20 mg, 0.033 mmol) and (4-methoxybenzene)boronic acid (5.3 mg, 0.035 mmol) were charged in a vial containing benzene (0.5 mL). The reaction was stirred at room temperature overnight. The solution was filtered through Celite®, the solvent was removed from the filtrate under vacuum and pentane (6 mL) was added. The resulting precipitate was collected on a frit, washed with pentane (3 x 3 mL) and dried under vacuum to afford 2j as a microcrystalline white solid (19.6 mg, 86%).

\[ \text{[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl](furan-2-yl)gold(I) (3m)} \]

\[^1\text{H NMR (CDCl}_3, 400\text{ MHz)}: \delta 7.95 (d, 2H, J = 9 Hz), 7.61 (t, 2H, J = 8 Hz), 7.41 (d, 1H, J = 8 Hz), 7.29 (s, 2H), 6.83 (d, 2H, J = 8.8 Hz), 3.86 (s, 3H), 2.71 (sept, 1H, J = 6.8 Hz), 1.52 (d, 12H, J = 6.8 Hz), 1.34 (d, 12H, J = 6.8 Hz). \]

\[^{13}\text{C NMR (CDCl}_3, 100\text{ MHz)}: \delta 197.1, 160.6, 145.9, 140.8, 134.8, 130.2, 122.8, 117.3, 112.8, 55.1, 28.9, 24.7, 24.1. \]


\[ \text{[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl](thiophen-2-yl)gold(I) (3n)} \]

\[^1\text{H NMR (CDCl}_3, 400\text{ MHz)}: \delta 7.50 (dd, 1H, J = 1.8, 0.6 Hz), 7.47 (t, 2H, J = 8 Hz), 7.28 (d, 1H, J = 7.6 Hz), 7.15 (s, 2H), 6.24 (dd, 1H, J = 3.0, 1.8 Hz), 5.81 (dd, 1H, J = 3.0, 0.6 Hz), 2.65 (sept, 1H, J = 6.8 Hz), 1.39 (d, 12H, J = 6.8 Hz), 1.23 (d, 12H, J = 6.8 Hz). \]

\[^{13}\text{C NMR (CDCl}_3, 100\text{ MHz)}: \delta 194.6, 192.3, 145.8, 143.9, 141.2, 134.5, 130.4, 124.1, 123.1, 117.9, 107.7, 28.9, 24.7, 24.1. \]

Anal. Calcd for C\(_{31}\)H\(_{39}\)AuN\(_2\)O: C, 57.05; H, 6.02; N, 4.29. Found: C, 57.13; H, 5.95; N, 4.20.

\[ \text{[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl](2-thiophen-2-yl)gold(I) (3l)} \]

\[^1\text{H NMR (CDCl}_3, 400\text{ MHz)}: \delta 7.47 (t, 2H, J = 8 Hz), 7.37 (dd, 1H, J = 4.6, 0.6 Hz), 7.28 (d, 1H, J = 7.6 Hz), 7.18-7.15 (m, 4H), 6.66 (dd, 1H, J = 3.2, 0.8 Hz), 2.66 (sept, 1H, J = 6.8 Hz), 1.40 (d, 12H, J = 6.8 Hz), 1.24 (d, 12H, J = 6.8 Hz). \]

\[^{13}\text{C NMR (CDCl}_3, 100\text{ MHz)}: \delta 194.3, 165.8, 145.8, 134.5, 132.3, 130.4, 126.7, 126.1, 124.1, 123.0, 28.9, 24.6, 24.1. \]

[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl](oxazol-2-yl)gold(I) (3o)

\[\text{N} \begin{array}{c} \text{O} \\ \text{Au(Pr)} \end{array} \text{N} \begin{array}{c} \text{O} \\ \text{Au(Pr)} \end{array} \]

$^1$H NMR (CDCl$_3$, 400 MHz): $\delta$ 7.88 (s, 1H), 7.49 (t, 2H, $J$ = 8 Hz), 7.29 (d, 1H, $J$ = 7.6 Hz), 7.17 (s, 2H), 6.41 (s, 1H), 2.62 (sept, 1H, $J$ = 6.8 Hz), 1.36 (d, 12H, $J$ = 6.8 Hz), 1.23 (d, 12H, $J$ = 6.8 Hz).

$^{13}$C NMR (CDCl$_3$, 100 MHz): $\delta$ 152.9, 145.8, 145.8, 134.3, 133.5, 129.2, 128.4, 124.2, 123.3, 28.9, 24.6, 24.1.

Anal. Calcd for C$_{30}$H$_{38}$AuN$_3$O: C, 55.13; H, 5.86; N, 6.43. Found: C, 55.19; H, 5.59; N, 6.38

[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl](benzofuran-2-yl)gold(I) (3p)

$^1$H NMR (CDCl$_3$, 400 MHz): $\delta$ 7.50 (dd, 1H, $J$ = 1.8, 0.6 Hz), 7.47 (t, 2H, $J$ = 8 Hz), 7.28 (d, 1H, $J$ = 7.6 Hz), 7.15 (s, 2H), 6.24 (dd, 1H, $J$ = 3.0, 1.8 Hz), 5.81 (dd, 1H, $J$ = 3.0, 0.6 Hz), 2.65 (sept, 1H, $J$ = 6.8 Hz), 1.39 (d, 12H, $J$ = 6.8 Hz), 1.23 (d, 12H, $J$ = 6.8 Hz).

$^{13}$C NMR (CDCl$_3$, 100 MHz): $\delta$ 194.6, 192.3, 145.8, 143.9, 141.2, 134.5, 130.4, 124.1, 123.1, 117.9, 107.7, 28.9, 24.7, 24.1.


[N,N-Bis(2,6-diisopropylphenyl)imidazol-2-yl](benzothiophen-2-yl)gold(I) (3q)

$^1$H NMR (CDCl$_3$, 400 MHz): $\delta$ 7.50 (dd, 1H, $J$ = 1.8, 0.6 Hz), 7.47 (t, 2H, $J$ = 8 Hz), 7.28 (d, 1H, $J$ = 7.6 Hz), 7.15 (s, 2H), 6.24 (dd, 1H, $J$ = 3.0, 1.8 Hz), 5.81 (dd, 1H, $J$ = 3.0, 0.6 Hz), 2.65 (sept, 1H, $J$ = 6.8 Hz), 1.39 (d, 12H, $J$ = 6.8 Hz), 1.23 (d, 12H, $J$ = 6.8 Hz).

$^{13}$C NMR (CDCl$_3$, 100 MHz): $\delta$ 194.1, 168.8, 145.9, 143.4, 141.7, 134.4, 130.5, 128.9, 124.2 123.1, 122.5, 121.7, 121.5, 121.1, 29.0, 24.7, 24.1.

Anal. Calcd for C$_{35}$H$_{41}$AuN$_2$S: C, 58.49; H, 5.75; N, 3.90. Found: C, 58.59; H, 5.64; N, 3.94.
Spectroscopic data for all organogold complexes:
Au(II)}
References