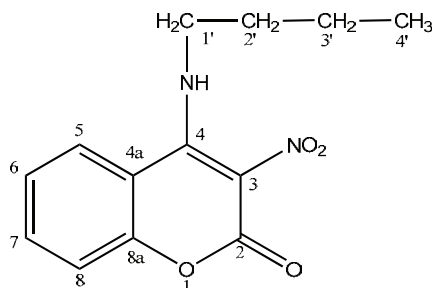


SUPPLEMENTARY MATERIAL TO
**A small library of 4-(alkylamino)-3-nitrocoumarin derivatives
with potent antimicrobial activity against gastrointestinal
pathogens**

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Atomic numbering of the coumarin derivatives using **5a** as an example.

PHYSICAL, ANALYTIC AND SPECTRAL DATA FOR THE PREPARED DERIVATIVES

4-(Butylamino)-3-nitro-2H-chromen-2-one (5a). Yield: 86 %; color: yellow; m.p.: 165–167 °C (lit. 168–169 °C¹); Anal. calcd. for C₁₃H₁₄N₂O₄: C, 59.54; H, 5.38; N, 10.68 %. Found C, 59.41; H, 5.28; N, 10.51 %; IR (neat, cm⁻¹): 3346–3180 (N–H and Ar–H), 2960 (C–H), 1683 (C=O), 1608 (C=C), 1520 and 1354 (NO₂), 1218, 1062, 744, 623; ¹H-NMR (200 MHz, DMSO-d₆, δ / ppm): 0.86 (3H, t, J = 7.0 Hz, H-4'), 1.22–1.38 (2H, m, H-3'), 1.56–1.70 (2H, m, H-2'), 3.10–3.16 (2H, m, H-1'), 7.38–7.49 (2H, m, H-6, H-8), 7.73 (1H, dt, J = 8.5, 1.5 Hz, H-7), 8.37 (1H, dd, J = 8.2, 1.5 Hz, H-5), 8.54 (1H, brs, N–H); ¹³C-NMR (50

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MHz, DMSO- d_6 , δ / ppm): 13.6, 19.6, 30.6, 44.3, 114.3, 115.7, 117.5, 124.3, 124.7, 134.0, 147.0, 151.0, 155.5; HRMS(EI): M^+ ($C_{13}H_{14}N_2O_4$), 262.0972; requires 262.0954 (Δ = +1.8 mmu); EI-MS (m/z , (relative abundance, %)): 262 (M^+ , 23), 216, 205, 159 (BP, 100), 131.

4-(sec-Butylamino)-3-nitro-2H-chromen-2-one (5b). Yield: 72 %; color: orange; m.p.: 208–210 °C; Anal. Calcd. for $C_{13}H_{14}N_2O_4$: C, 59.54; H, 5.38; N, 10.68 %. Found C, 59.48; H, 5.32; N, 10.60 %; IR (neat, cm^{-1}): 3338–3062 (N–H and Ar–H), 2933 (C–H), 1677 (C=O), 1606 (C=C), 1556 and 1317 (NO_2), 1061, 916, 743; 1H -NMR (200 MHz, DMSO- d_6 , δ / ppm): 1.02 (3H, *t*, J = 6.4 Hz, H-3'), 1.52 (3H, *d*, J = 6.5 Hz, H-1''), 1.73–1.87 (2H, *m*, H-2'), 4.15–4.36 (1H, *m*, H-1'), 7.33–7.40 (2H, *m*, H-6, H-8), 7.69 (1H, *dt*, J = 7.5, 1.5 Hz, H-7), 7.89 (1H, *dd*, J = 8.5, 1.5 Hz, H-5), 9.99 (1H, *brs*, N–H); ^{13}C -NMR (50 MHz, DMSO- d_6 , δ / ppm): 10.1, 21.3, 31.3, 55.3, 110.6, 113.1, 118.6, 124.2, 126.2, 134.9, 152.8, 153.2, 154.5; HRMS(EI): M^+ ($C_{13}H_{14}N_2O_4$), 262.0942; requires 262.0954 (Δ = –1.2 mmu); EI-MS (m/z , (relative abundance, %)): 262 (M^+ , 16), 247, 216, 205, 159 (BP, 100).

4-(tert-Butylamino)-3-nitro-2H-chromen-2-one (5c). Yield: 75 %; color: yellow; m.p.: 134–136 °C (lit. 136–138 °C¹); Anal. Calcd. for $C_{13}H_{14}N_2O_4$: C, 59.54; H, 5.38; N, 10.68 %. Found C, 59.60; H, 5.37; N, 10.77 %; IR (neat, cm^{-1}): 3325–3036 (N–H and Ar–H), 2975 (C–H), 1698 (C=O), 1600 (C=C), 1543 and 1360 (NO_2), 1176, 1030, 762; 1H -NMR (200 MHz, DMSO- d_6 , δ / ppm): 1.59 (9H, *s*, CH_3), 7.28–7.40 (2H, *m*, H-6, H-8), 7.69 (1H, *dt*, J = 8.0, 1.0 Hz, H-7), 7.98 (1H, *dd*, J = 8.2, 1.0 Hz, H-5), 9.56 (1H, *brs*, N–H); ^{13}C -NMR (50 MHz, DMSO- d_6 , δ / ppm): 31.7 (three C), 59.3, 114.4, 114.5, 117.9, 123.4, 128.8, 135.0, 152.6, 154.4, 155.2; HRMS(EI): M^+ ($C_{13}H_{14}N_2O_4$), 262.0947; requires 262.0954 (Δ = –0.7 mmu); EI-MS (m/z , (relative abundance %)): 262 (M^+ , 10), 247, 216, 205, 159 (BP, 100).

4-[(3-Hydroxypropyl)amino]-3-nitro-2H-chromen-2-one (5d). Yield: 83 %; color: yellow; m.p.: 158–160 °C; Anal. Calcd. for $C_{12}H_{12}N_2O_5$: C, 54.55; H, 4.58; N, 10.60 %. Found C, 54.63; H, 4.60; N, 10.53 %; IR (neat, cm^{-1}): 3393–3216 (N–H and Ar–H), 2941 (C–H), 1695 (C=O), 1609 (C=C), 1551 and 1347 (NO_2), 1223, 1051, 879, 757, 637; 1H -NMR (200 MHz, DMSO- d_6 , δ / ppm): 1.76–1.89 (2H, *m*, H-2'), 3.25 (2H, *t*, J = 6.6 Hz, H-1'), 3.48 (2H, *t*, J = 5.8 Hz, H-3'), 4.77 (1H, *brs*, OH), 7.38–7.48 (2H, *m*, H-6, H-8), 7.73 (1H, *dt*, J = 8.4, 1.2 Hz, H-7), 8.31 (1H, *dd*, J = 8.2, 1.2 Hz, H-5), 8.57 (1H, *brs*, N–H); ^{13}C -NMR (50 MHz, DMSO- d_6 , δ / ppm): 31.4, 42.7, 58.5, 114.3, 115.6, 117.6, 124.3, 124.7, 134.1, 147.4, 151.0, 155.5; HRMS(EI): M^+ ($C_{12}H_{12}N_2O_5$), 264.0757; requires 264.0746 (Δ = +1.1 mmu); EI-MS (m/z , (relative abundance %)): 264 (M^+ , 7), 246, 200, 159 (BP, 100), 115.

4-(Hexylamino)-3-nitro-2H-chromen-2-one (5e). Yield: 92 %; color: yellow; m.p.: 116–118 °C; Anal. Calcd. for $C_{15}H_{18}N_2O_4$: C, 62.06; H, 6.25; N, 9.65 %.

Found C, 61.97; H, 6.15; N, 9.54 %; IR (neat, cm^{-1}): 3345–3216 (N–H and Ar–H), 2925 (C–H), 1683 (C=O), 1605 (C=C), 1542 and 1364 (NO_2), 1219, 1059, 753, 625; ^1H -NMR (200 MHz, $\text{DMSO}-d_6$, δ / ppm): 0.79–0.88 (3H, *m*, H-6'), 1.17–1.31 (6H, *m*, H-3', H-4', H-5'), 1.55–1.72 (2H, *m*, H-2'), 3.14 (2H, *t*, J = 7.6 Hz, H-1'), 7.39–7.49 (2H, *m*, H-6, H-8), 7.73 (1H, *dt*, J = 8.2, 1.0 Hz, H-7), 8.35 (1H, *dd*, J = 8.0, 1.0 Hz, H-5), 8.47 (1H, *brs*, N–H); ^{13}C -NMR (50 MHz, $\text{DMSO}-d_6$, δ / ppm): 13.9, 22.0, 26.0, 28.6, 30.8, 44.6, 114.3, 115.7, 117.6, 124.3, 124.7, 134.0, 147.0, 151.0, 155.4; HRMS(EI): M^+ ($\text{C}_{15}\text{H}_{18}\text{N}_2\text{O}_4$), 290.1276; requires 290.1267 (Δ = +0.9 mmu); EI-MS (m/z , (relative abundance %)): 290 (M^+ , 10), 244, 219, 205, 159 (BP, 100).

3-Nitro-4-(octylamino)-2H-chromen-2-one (5f). Yield: 78 %; color: yellow; m.p.: 128–130 °C; Anal. Calcd. for $\text{C}_{17}\text{H}_{22}\text{N}_2\text{O}_4$: C, 64.13; H, 6.97; N, 8.80 %. Found C, 64.08; H, 7.04; N, 8.78 %; IR (neat, cm^{-1}): 3337–3048 (N–H and Ar–H), 2957 (C–H), 1685 (C=O), 1603 (C=C), 1539 and 1359 (NO_2), 1215, 1055, 916, 750; ^1H -NMR (200 MHz, $\text{DMSO}-d_6$, δ / ppm): 0.89 (3H, *t*, J = 6.6 Hz, H-8'), 1.29–1.52 (10H, *m*, H-3', H-4', H-5', H-6', H-7'), 1.79–1.93 (2H, *m*, H-2'), 3.82–3.91 (2H, *m*, H-1'), 7.32–7.40 (2H, *m*, H-6, H-8), 7.69 (1H, *dt*, J = 8.2, 1.4 Hz, H-7), 8.00 (1H, *dd*, J = 8.4, 1.4 Hz, H-5), 10.16 (1H, *brs*, N–H); ^{13}C -NMR (50 MHz, $\text{DMSO}-d_6$, δ / ppm): 13.9, 22.5, 26.5, 28.9 (two C), 30.3, 31.6, 48.5, 113.2, 118.5, 124.1, 126.6, 126.7, 135.0, 152.9, 154.5, 158.5; HRMS(EI): M^+ ($\text{C}_{17}\text{H}_{22}\text{N}_2\text{O}_4$), 318.1574; requires 318.1580 (Δ = –0.6 mmu); EI-MS (m/z , (relative abundance %)): 318 (M^+ , 7), 272, 205, 159 (BP, 100).

4-(Hexadecylamino)-3-nitro-2H-chromen-2-one (5g). Yield: 81 %; color: yellow; m.p.: 120–122 °C; Anal. Calcd. for $\text{C}_{25}\text{H}_{38}\text{N}_2\text{O}_4$: C, 69.74; H, 8.90; N, 6.51 %. Found C, 69.82; H, 8.88; N, 6.49 %; IR (neat, cm^{-1}): 3336–3180 (N–H and Ar–H), 2955 (C–H), 1690 (C=O), 1609 (C=C), 1517 and 1327 (NO_2), 1066, 787, 747; ^1H -NMR (200 MHz, $\text{DMSO}-d_6$, δ / ppm): 0.85 (3H, *t*, H-16'), 1.22 (26H, *brs*, H-3'–15'), 1.51–1.64 (2H, *m*, H-2'), 7.39–7.48 (2H, *m*, H-6, H-8), 3.10 (2H, *t*, H-1'), 7.74 (1H, *dt*, J = 8.0, 1.0 Hz, H-7), 8.36 (1H, *dd*, J = 8.4, 1.0 Hz, H-5); ^{13}C -NMR (50 MHz, $\text{DMSO}-d_6$, δ / ppm): 14.1, 22.2, 26.2, 28.5, 28.8, 28.9, 29.0, 29.1 (five C), 31.4 (two C), 44.6, 96.8, 114.3, 117.6, 124.3, 124.7, 134.0, 147.0, 151.0, 155.5; HRMS(EI): M^+ ($\text{C}_{25}\text{H}_{38}\text{N}_2\text{O}_4$), 430.2823; requires 430.2832 (Δ = –0.9 mmu); EI-MS (m/z , (relative abundance %)): 430 (M^+ , 4), 384, 205, 159 (BP, 100).

4-[(Furan-2-ylmethyl)amino]-3-nitro-2H-chromen-2-one (5h). Yield: 74 %; color: yellow; m.p.: 234–236 °C; Anal. Calcd. for $\text{C}_{14}\text{H}_{10}\text{N}_2\text{O}_5$: C, 58.74; H, 3.52; N, 9.79 %. Found C, 58.78; H, 3.61; N, 9.80 %; IR (neat, cm^{-1}): 3336–3130 (N–H and Ar–H), 1686 (C=O), 1605 (C=C), 1551 and 1326 (NO_2), 1015, 884, 750; ^1H -NMR (200 MHz, $\text{DMSO}-d_6$, δ / ppm): 3.42 (2H, *s*, CH_2), 6.34–6.45 (2H, *m*, H-4', H-5'), 7.40–7.50 (2H, *m*, H-6, H-8), 7.64 (1H, *dd*, J = 2.6, 0.8 Hz, H-3'), 7.75 (1H, *dt*, J = 8.4, 1.4 Hz, H-7), 8.35 (1H, *dd*, J = 8.4, 1.4 Hz, H-5),

9.09 (1H, *brs*, N–H); ^{13}C -NMR (50 MHz, DMSO- d_6 , δ / ppm): 40.0, 109.4, 111.0 (two C), 114.4, 117.7, 124.5, 124.9, 134.4, 143.5, 147.3, 149.0, 151.2, 155.3; HRMS(EI): M^+ ($\text{C}_{14}\text{H}_{10}\text{N}_2\text{O}_5$), 286.0577; requires 286.0590 ($\Delta = -1.3$ mmu); EI-MS (m/z , (relative abundance %)): 286 (M^+ , 37), 240, 205, 159 (BP, 100), 81.

4-(Benzylamino)-3-nitro-2H-chromen-2-one (5i). Yield: 86 %; color: yellow; m.p.: 182–184 °C (lit. 180–181 °C 1); Anal. Calcd. for $\text{C}_{16}\text{H}_{12}\text{N}_2\text{O}_4$: C, 64.86; H, 4.08; N, 9.46 %. Found C, 64.79; H, 3.97; N, 9.36 %; IR (neat, cm^{-1}): 3336–3030 (N–H and Ar–H), 1682 (C=O), 1606 (C=C), 1511 and 1323 (NO_2), 1217, 1062, 738, 692; ^1H -NMR (200 MHz, DMSO- d_6 , δ / ppm): 3.36 (2H, *s*, CH_2), 7.26–7.34 (5H, *m*, H-2', H-3', H-4', H-5', H-6'), 7.41–7.50 (2H, *m*, H-6, H-8), 7.75 (1H, *t*, $J = 8.0$ Hz, H-7), 8.42 (1H, *dd*, $J = 8.2, 1.0$ Hz, H-5), 9.21 (1H, *brs*, N–H); ^{13}C -NMR (50 MHz, DMSO- d_6 , δ / ppm): 47.9, 114.4, 116.3, 117.6, 124.5, 124.8, 127.3 (two C), 127.8, 128.7 (two C), 134.2, 136.7, 147.3, 151.1, 155.3; HRMS(EI): M^+ ($\text{C}_{16}\text{H}_{12}\text{N}_2\text{O}_4$), 296.0813; requires 296.0797 ($\Delta = +1.6$ mmu); EI-MS (m/z , (relative abundance %)): 296 (M^+ , 44), 250, 205, 159 (BP, 100), 91.

REFERENCES

1. V. Savel'ev, O. Artamonova, V. Troitskaya, V. Vinokurov, V. Zagorevskii, *Khim. Geterotsikl. Soedin.* **7** (1973) 885.