

Supporting Information

Design, Synthesis, Structural Studies, Biological Evaluation, and Computational Simulations of Novel Potent AT₁ Angiotensin II Receptor Antagonists Based on the 4-Phenylquinoline Structure.

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Experimental Details

Chemistry

Melting points were determined in open capillaries on a Gallenkamp apparatus and are uncorrected. Microanalyses were carried out using a Perkin-Elmer 240C elemental analyzer. Merck silica gel 60 (70-230 or 230-400 mesh) was used for column chromatography. Merck TLC plates, silica gel 60 F₂₅₄ were used for TLC. ¹H-NMR spectra were recorded with a Bruker AC 200 spectrometer in the indicated solvents (TMS as internal standard): the values of the chemical shifts are expressed in ppm and the coupling constants (*J*) in Hz. Mass spectra (EI, 70 eV) were recorded either on a VG 70-250S spectrometer (Centro di Analisi e Determinazioni Strutturali - Università di Siena) or Varian Saturn 3 (Dipartimento Farmaco Chimico Tecnologico - Università di Siena).

Preparation of Target Tetrazole Derivatives 4b,l,o (Deprotection of the Trityl-Protected Tetrazole Derivatives). A mixture of the appropriate trityl-protected tetrazole derivative (1.0 mmol) with formic acid (15 mL) was stirred at room temperature under argon for a suitable time (2-44 h), and the reaction progress was monitored by TLC. When the trityl-protected tetrazole derivative disappeared from the chromatogram, the reaction mixture was evaporated under reduced pressure. Purification of the residue by washing with diethyl ether gave the pure target compounds.

4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-(2*H*-tetrazol-5-yl)quinoline (4b). The title compound was prepared from **6b** to obtain a white crystalline solid (0.36 g, 78%) melting at 257-259 °C. ¹H-NMR (CDCl₃): 1.20 (t, *J* = 7.5, 3H), 2.56 (s, 3H), 2.61 (s, 3H), 2.82 (q, *J* = 7.5, 2H), 5.57 (s, 2H), 6.93 (s, 1H), 7.25 (m, 4H), 7.52 (m, 2H), 7.79 (m, 1H), 8.22 (d, *J* = 8.3, 1H), 9.53 (s, 1H). Anal. (C₂₇H₂₄N₈·0.5H₂O) C, H, N.

4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-1-methyl-3-(2*H*-tetrazol-5-yl)-2(1*H*)quinolinone (4l). The title compound was prepared from **6l** to obtain a white crystalline solid (0.34 g, 69%) melting at 270-272 °C. ¹H-NMR (CDCl₃): 1.38 (t, *J* = 7.6, 3H), 2.61

(s, 3H), 2.63 (s, 3H), 2.90 (q, $J = 7.6$, 2H), 3.93 (s, 3H), 5.59 (s, 2H), 6.89 (s, 1H), 7.22 (m, 6H), 7.52 (d, $J = 8.4$, 1H), 7.68 (m, 1H). Anal. ($C_{28}H_{26}N_8O \cdot 0.67H_2O$) C, H, N.

4-[4-[(5,7-Dimethyl-2-propyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-(2*H*-tetrazol-5-yl)quinoline (4o). The title compound was prepared from **6o** to obtain a white crystalline solid (0.37 g, 78%, mp 236-238 °C). 1H -NMR ($CDCl_3$): 0.89 (t, $J = 7.5$, 3H), 1.65 (m, 2H), 2.57 (s, 3H), 2.61 (s, 3H), 2.80 (t, $J = 7.4$, 2H), 5.57 (s, 2H), 6.93 (s, 1H), 7.28 (m, 4H), 7.52 (m, 2H), 7.78 (m, 1H), 8.22 (d, $J = 8.4$, 1H), 9.51 (s, 1H). Anal. ($C_{28}H_{26}N_8$) C, H, N.

Preparation of Target Carboxylic Acid Derivatives 4a,c-k,m,p-t,v,w (Basic Hydrolysis).

To a solution of the appropriate ester (**6a,c-k,m,p-t,v,w**) (1.0 mmol) in the suitable solvent (ethanol, THF, dioxan, or ethylene glycol) (40 mL) was added 1N NaOH (10 mL) and the resulting mixture was refluxed while the reaction progress was monitored by TLC. When the ester derivative disappeared from the chromatogram, the reaction mixture was evaporated under reduced pressure, diluted with water (20 mL) and the pH was adjusted to 5-6 by addition of 1N HCl. The precipitate was collected by filtration (or extracted with chloroform when necessary), washed with water and dried under reduced pressure. Purification of the solid obtained by recrystallization from the suitable solvent or by washing with ethyl acetate or diethyl ether gave pure target carboxylic acid derivatives.

1-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-2-naphthalenecarboxylic Acid (4a). The title compound was obtained from ester **6a** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 90%, mp 245-247 °C). 1H -NMR ($DMSO-d_6$): 1.27 (t, $J = 7.3$, 3H), 2.53 (s, 3H), 2.54 (s, 3H), 2.84 (q, $J = 7.3$, 2H), 5.56 (s, 2H), 6.97 (s, 1H), 7.22 (m, 4H), 7.40 (m, 2H), 7.55 (m, 1H), 7.81 (d, $J = 8.6$, 1H), 8.01 (d, $J = 8.4$, 2H), 12.65 (br s, 1H). MS (EI): m/z 435 (M^+ , 5). Anal. ($C_{28}H_{25}N_3O_2 \cdot 3H_2O$) C, H, N.

4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylic Acid (4c). The title compound was obtained from ester **6c** by means of the

basic hydrolysis procedure employing ethanol as the solvent (yield 98%, mp 293-295 °C). ¹H-NMR: (CDCl₃): 1.00 (t, *J* = 7.5, 3H), 2.61 (s, 6H), 2.78 (q, *J* = 7.5, 2H), 5.57 (s, 2H), 6.95 (s, 1H), 7.29 (m, 4H), 7.48 (m, 2H), 7.77 (m, 1H), 8.21 (d, *J* = 8.3, 1H), 9.39 (s, 1H). Anal. (C₂₇H₂₄N₄O₂·H₂O) C, H, N.

4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-2-methoxy-3-quinolinecarboxylic Acid (4d). This compound was obtained from ester **6d** by means of the basic hydrolysis procedure employing ethanol as the solvent and was recrystallized from ethanol to obtain X-ray quality crystals (yield 72%, mp 210-211 °C). ¹H-NMR: (CDCl₃): 0.88 (t, *J* = 7.5, 3H), 2.67 (m, 8H), 4.13 (s, 3H), 5.53 (s, 2H), 6.95 (s, 1H), 7.27 (m, 3H), 7.48 (m, 3H), 7.63 (m, 1H), 7.89 (d, *J* = 8.1, 1H). Anal. (C₂₈H₂₆N₄O₃·0.5H₂O·0.5C₂H₅OH) C, H, N.

2-Amino-4-[4-[(5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylic Acid (4e). The title compound was obtained from ester **6e** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 66%, mp 202 °C dec.). ¹H-NMR: (CDCl₃): 1.21 (t, *J* = 7.5, 3H), 2.57 (s, 3H), 2.62 (s, 3H), 2.74 (q, *J* = 7.5, 2H), 5.50 (s, 2H), 6.90 (m, 2H), 7.15 (m, 2H), 7.32 (s, 4H), 7.75 (m, 1H), 9.50 (br s, 1H), 10.89 (br s, 1H). MS (FAB): *m/z* 452 (M+1). Anal. (C₂₇H₂₅N₅O₂) C, H, N.

4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-2-methylamino-3-quinolinecarboxylic Acid (4f). The title compound was obtained from ester **6f** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 97%, mp 261 °C). ¹H-NMR (DMSO-*d*₆): 1.23 (t, *J* = 7.4, 3H), 2.49 (s, 6H), 2.79 (q, *J* = 7.4, 2H), 2.93 (s, 3H), 5.52 (s, 2H), 6.73 (br s, 1H), 6.93 (s, 1H), 7.05 (m, 2H), 7.21 (s, 4H), 7.53 (m, 2H). MS (FAB): *m/z* 466 (M+1). Anal. (C₂₈H₂₇N₅O₂) C, H, N.

4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-2-dimethylamino-3-quinolinecarboxylic Acid (4g). The title compound was obtained from ester **6g** by means of the basic hydrolysis procedure employing ethylene glycol as the solvent (yield 64%, mp 211 °C). ¹H-NMR (CDCl₃): 0.97 (t, *J* = 7.5, 3H), 2.55 (s, 3H), 2.58 (s, 3H), 2.67 (q, *J* = 7.5, 2H), 3.12 (s, 6H),

5.47 (s, 2H), 6.89 (s, 1H), 7.14-7.32 (m, 6H), 7.54 (m, 1H), 7.79 (d, $J = 8.4$, 1H). MS (FAB): m/z 480 (M+1). Anal. ($C_{29}H_{29}N_5O_2 \cdot 2H_2O$) C, H, N.

4-[4-[(5,7-Dimethyl-2-ethyl-3H-imidazo[4,5-b]pyridin-3-yl)methyl]phenyl]-2-propylamino-3-quinolinecarboxylic Acid (4h). The title compound was obtained from ester **6h** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 89%, mp 245-246 °C). 1H -NMR (DMSO- d_6): 0.94 (t, $J = 7.4$, 3H), 1.27 (t, $J = 7.4$, 3H), 1.65 (m, 2H), 2.54 (s, 6H), 2.84 (q, $J = 7.3$, 2H), 3.46 (t, $J = 7.0$, 2H), 5.56 (s, 2H), 6.98 (s, 1H), 7.10 (m, 2H), 7.29 (m, 4H), 7.56 (m, 2H). Anal. ($C_{30}H_{31}N_5O_2 \cdot 0.33H_2O$) C, H, N.

4-[4-[(5,7-Dimethyl-2-ethyl-3H-imidazo[4,5-b]pyridin-3-yl)methyl]phenyl]-2-dipropylamino-3-quinolinecarboxylic Acid (4i). The title compound was obtained from ester **6i** by means of the basic hydrolysis procedure employing ethylene glycol as the solvent (yield 75%, mp 238-241 °C). 1H -NMR ($CDCl_3$): 0.85 (t, $J = 7.4$, 6H), 1.09 (t, $J = 7.4$, 3H), 1.61 (m, 4H), 2.58 (s, 3H), 2.60 (s, 3H), 2.77 (q, $J = 7.5$, 2H), 3.41 (t, $J = 7.5$, 4H), 5.52 (s, 2H), 6.90 (s, 1H), 7.25 (m, 6H), 7.63 (m, 1H), 7.88 (d, $J = 8.3$, 1H). Anal. ($C_{33}H_{37}N_5O_2$) C, H, N.

4-[4-[(5,7-Dimethyl-2-ethyl-3H-imidazo[4,5-b]pyridin-3-yl)methyl]phenyl]-3-quinolineacetic Acid (4j). This compound was obtained from ester **6j** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 93%, mp 297 °C). 1H -NMR: ($CDCl_3$): 1.23 (t, $J = 7.4$, 3H), 2.53 (s, 3H), 2.57 (s, 3H), 2.78 (q, $J = 7.4$, 2H), 3.45 (s, 2H), 5.44 (s, 2H), 6.85 (s, 1H), 7.15 (s, 4H), 7.26 (m, 2H), 7.51 (m, 1H), 8.00 (d, $J = 8.0$, 1H), 8.85 (s, 1H). MS (FAB): m/z 451 (M+1). Anal. ($C_{28}H_{26}N_4O_2 \cdot 2H_2O$) C, H, N.

2-Chloro-4-[4-[(5,7-dimethyl-2-ethyl-3H-imidazo[4,5-b]pyridin-3-yl)methyl]phenyl]-3-quinolineacetic Acid (4k). This compound was obtained from ester **6k** by means of the basic hydrolysis procedure employing THF as the solvent and was purified by flash chromatography with ethyl acetate-methanol (7:3) as the eluent (yield 53%, mp 162 °C dec.). 1H -NMR: ($CDCl_3$): 1.23 (t, $J = 7.4$, 3H), 2.60 (s, 6H), 2.84 (q, $J = 7.4$, 2H), 3.67 (s, 2H), 5.56 (s, 2H), 6.91 (s, 1H), 7.25 (m,

5H), 7.39 (m, 1H), 7.66 (m, 1H), 8.02 (d, $J = 8.4$, 1H). MS (FAB): m/z 485 (M+1). Anal. ($C_{28}H_{25}ClN_4O_2$) C, H, N.

1,2-Dihydro-4-[4-[(5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-1-methyl-2-oxo-3-quinolinecarboxylic Acid (4m). The title compound was obtained from ester **6m** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 89%, mp 214-215 °C). 1H -NMR: ($CDCl_3$): 1.34 (t, $J = 7.6$, 3H), 2.60 (s, 3H), 2.63 (s, 3H), 2.86 (q, $J = 7.5$, 2H), 3.91 (s, 3H), 5.55 (s, 2H), 6.90 (s, 1H), 7.11 (d, $J = 8.3$, 2H), 7.22 (m, 4H), 7.52 (d, $J = 8.4$, 1H), 7.72 (m, 1H). Anal. ($C_{28}H_{26}N_4O_3 \cdot 1.5H_2O$) C, H, N.

5-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl][1,2,3,4]tetrazolo[1,5-*a*]quinoline-4-carboxylic Acid (4n). The title compound was obtained from ester **6n** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 85%, mp 292 °C). Moreover, compound **4n** was obtained in low yield (18%) as a by-product of the reaction leading to ester **6n**. 1H -NMR: ($DMSO-d_6$): 1.24 (t, $J = 7.4$, 3H), 2.50 (s, 6H), 2.81 (q, $J = 7.4$, 2H), 5.56 (s, 2H), 6.94 (s, 1H), 7.30 (d, $J = 7.9$, 2H), 7.39 (d, $J = 8.0$, 2H), 7.51 (d, $J = 8.2$, 1H), 7.72 (t, $J = 7.9$, 1H), 8.00 (t, $J = 7.7$, 1H), 8.69 (d, $J = 8.1$, 1H). Anal. ($C_{27}H_{23}N_7O_2$) C, H, N.

4-[4-[(5,7-Dimethyl-2-propyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylic Acid (4p). The title compound was obtained from ester **6p** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 86%, mp 290-292 °C). 1H -NMR: ($CDCl_3$): 0.65 (t, $J = 7.3$, 3H), 1.46 (m, 2H), 2.57 (s, 3H), 2.59 (s, 3H), 2.67 (t, $J = 7.6$, 2H), 5.54 (s, 2H), 6.92 (s, 1H), 7.28 (m, 4H), 7.48 (m, 2H), 7.75 (m, 1H), 8.18 (d, $J = 8.4$, 1H), 9.38 (s, 1H). MS (FAB): m/z 451 (M+1). Anal. ($C_{28}H_{26}N_4O_2 \cdot 1.5H_2O$) C, H, N.

2-Chloro-4-[4-[(5,7-dimethyl-2-propyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylic Acid (4q). This compound was obtained from ester **6q** by means of the basic hydrolysis procedure employing dioxan as the solvent (reaction time 24 h) and was purified by flash chromatography with ethyl acetate-methanol (7:3) as the eluent (yield 51%, mp 206-207 °C). 1H -

NMR: (DMSO- d_6): 0.92 (t, $J = 7.4$, 3H), 1.72 (m, 2H), 2.50 (s, 6H), 2.79 (t, $J = 7.5$, 2H), 5.52 (s, 2H), 6.93 (s, 1H), 7.17 (d, $J = 7.9$, 2H), 7.35 (m, 4H), 7.65 (m, 1H), 7.88 (d, $J = 8.2$, 1H). MS (FAB): m/z 485 (M+1). Anal. ($C_{28}H_{25}ClN_4O_2$) C, H, N.

4-[4-[(5,7-Dimethyl-2-propyl-3H-imidazo[4,5-b]pyridin-3-yl)methyl]phenyl]-2-methyl-3-quinolinecarboxylic Acid (4r). This compound was obtained from ester **6r** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 92%, mp 295 °C). 1H -NMR: (DMSO- d_6): 0.91 (t, $J = 7.3$, 3H), 1.70 (m, 2H), 2.50 (s, 6H), 2.65 (s, 3H), 2.76 (t, $J = 7.5$, 2H), 5.54 (s, 2H), 6.94 (s, 1H), 7.27 (m, 5H), 7.46 (t, $J = 7.4$, 1H), 7.73 (t, $J = 7.4$, 1H), 7.98 (d, $J = 8.2$, 1H), 12.75 (br s, 1H). Anal. ($C_{29}H_{28}N_4O_2 \cdot 0.33H_2O$) C, H, N.

4-[4-[(5,7-Dimethyl-2-propyl-3H-imidazo[4,5-b]pyridin-3-yl)methyl]phenyl]-2-hydroxy-3-quinolinecarboxylic Acid (4s). This compound was obtained from ester **6q** by means of the basic hydrolysis procedure employing dioxan as the solvent (reaction time 5 days) and was purified by washing with ethyl acetate (yield 62%, mp 236-238 °C). 1H -NMR: (DMSO- d_6): 0.92 (t, $J = 7.3$, 3H), 1.72 (m, 2H), 2.47 (s, 3H), 2.49 (s, 3H), 2.78 (t, $J = 7.3$, 2H), 5.50 (s, 2H), 6.92 (s, 1H), 7.16 (m, 4H), 7.34 (m, 2H), 7.50 (m, 1H), 7.68 (d, $J = 8.1$, 1H). MS (FAB): m/z 467 (M+1). Anal. ($C_{28}H_{26}N_4O_3 \cdot H_2O$) C, H, N.

2-Amino-4-[4-[(5,7-dimethyl-2-propyl-3H-imidazo[4,5-b]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylic Acid (4t). The title compound was obtained from ester **6t** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 69%, mp 218-219 °C). 1H -NMR: ($CDCl_3$): 0.90 (t, $J = 7.3$, 3H), 1.68 (m, 2H), 2.59 (s, 3H), 2.63 (s, 3H), 2.72 (t, $J = 7.6$, 2H), 5.52 (s, 2H), 6.89 (m, 2H), 7.22 (m, 2H), 7.33 (s, 4H), 7.75 (m, 1H), 9.61 (br s, 1H), 10.93 (br s, 1H), 16.82 (br s, 1H). Anal. ($C_{28}H_{27}N_5O_2 \cdot 0.67H_2O$) C, H, N.

4-[4-[(2-Butyl-5,7-dimethyl-3H-imidazo[4,5-b]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylic Acid (4v). The title compound was obtained from ester **6v** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 72%, mp 295-296 °C). 1H -NMR: (DMSO- d_6): 0.84 (t, $J = 7.3$, 3H), 1.32 (m, 2H), 1.63 (m, 2H), 2.49 (s, 3H), 2.51 (s, 3H), 2.79

(t, $J = 7.5$, 2H), 5.55 (s, 2H), 6.94 (s, 1H), 7.24 (m, 4H), 7.39 (d, $J = 8.3$, 1H), 7.53 (t, $J = 7.6$, 1H), 7.81 (t, $J = 7.5$, 1H), 8.09 (d, $J = 8.3$, 1H), 9.17 (s, 1H), 13.57 (br s, 1H). Anal. ($C_{29}H_{28}N_4O_2 \cdot 0.33H_2O$) C, H, N.

2-Amino-4-[4-[(2-butyl-5,7-dimethyl-3H-imidazo[4,5-b]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylic Acid (4w). The title compound was obtained from ester **6w** by means of the basic hydrolysis procedure employing ethanol as the solvent (yield 78%, mp 270-271 °C). 1H -NMR: (DMSO- d_6): 0.83 (t, $J = 7.3$, 3H), 1.31 (m, 2H), 1.61 (m, 2H), 2.49 (s, 3H), 2.51 (s, 3H), 2.78 (t, $J = 7.6$, 2H), 5.53 (s, 2H), 6.94 (s, 1H), 7.06 (m, 2H), 7.21 (m, 4H), 7.50 (m, 2H). Anal. ($C_{29}H_{29}N_5O_2 \cdot 0.67H_2O$) C, H, N.

4-[4-[(5,7-Dimethyl-2-ethyl-3H-imidazo[4,5-b]pyridin-3-yl)methyl]phenyl]-N-(4-nitrophenylsulfonyl)-3-quinolinecarboxamide (4u). A mixture of **4p** (0.10 g, 0.22 mmol) in dichloromethane (20 mL) with 4-dimethylaminopyridine (DMAP) (0.029 g, 0.24 mmol), 4-nitrobenzenesulfonamide (0.048 g, 0.24 mmol), and 1-[3-(dimethylamino)propyl]-3-ethylcarbodiimide hydrochloride (EDCI) (0.046 g, 0.24 mmol) was stirred at room temperature for 48 h under argon. The solvent was removed under reduced pressure and the residue was purified by flash chromatography with ethyl acetate-methanol (7:3) as the eluent to give pure **4u** as a white solid (0.093 g, yield 67%, mp 285 °C dec.). 1H -NMR: (DMSO- d_6): 0.89 (t, $J = 7.4$, 3H), 1.69 (m, 2H), 2.49 (s, 6H), 2.75 (t, $J = 7.5$, 2H), 5.50 (s, 2H), 6.93 (s, 1H), 7.07 (m, 4H), 7.39 (m, 2H), 7.68 (m, 3H), 7.99 (d, $J = 8.2$, 1H), 8.10 (d, $J = 8.6$, 2H), 8.93 (s, 1H). MS (FAB): m/z 635 (M+1). Anal. ($C_{34}H_{30}N_6O_5S \cdot 3H_2O$) C, H, N.

General Procedure for the Preparation of Compounds **6a-d,k-m,o-q,v,x,y** (Bromination-Coupling Procedure).

A mixture of the toluene derivative **5a-d,k-m,q** (1.5 mmol) in 40 mL of CCl_4 with *N*-bromosuccinimide (0.27 g, 1.5 mmol) and dibenzoyl peroxide (0.03 g, 0.12 mmol) was refluxed for

a suitable time (typically 2-3 h), and the reaction progress was monitored by TLC. The initial solvent volume was reduced by half under reduced pressure, the insoluble succinimide was filtered-off, and the resulting mixture was evaporated under reduced pressure. The residue was dissolved into anhydrous DMF (10 mL) and added to a mixture (aged at 0 °C for 20 min) of the appropriate 2-alkyl-5,7-dimethyl-3*H*-imidazo[4,5-*b*]pyridine¹ (1.5 mmol) in anhydrous DMF (10 mL) with NaH (0.036 g, 1.5 mmol). The resulting mixture was stirred at room temperature for 15-18 h under argon and the reaction was quenched with water (5 mL). The bulk of the DMF was evaporated under reduced pressure, and the residue was diluted with water (20 mL) and extracted with chloroform. The combined organic extracts were washed with brine, dried over sodium sulfate and concentrated under reduced pressure. Purification of the residue by flash chromatography with ethyl acetate as the eluent gave pure compounds **6a-d,k-m,o-q,v,x,y**.

4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-[2-(triphenylmethyl)-2*H*-tetrazol-5-yl]quinoline (6b). The title compound was prepared from **5b** and 5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a white solid (0.495 g, 47%) melting at 188-189 °C. ¹H-NMR (CDCl₃): 1.26 (t, *J* = 7.6, 3H), 2.59 (s, 3H), 2.65 (s, 3H), 2.73 (q, *J* = 7.5, 2H), 5.39 (s, 2H), 6.92 (m, 7H), 7.04 (d, *J* = 8.3, 2H), 7.12 (d, *J* = 8.0, 2H), 7.26 (m, 9H), 7.39 (m, 2H), 7.73 (m, 1H), 8.17 (d, *J* = 8.5, 1H), 9.48 (s, 1H).

4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-1-methyl-3-[2-(triphenylmethyl)-2*H*-tetrazol-5-yl]-2(1*H*)quinolinone (6l). The title compound was prepared from **5l** and 5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a white solid (0.18 g, 16%) melting at 198-199 °C. ¹H-NMR (CDCl₃): 1.21 (t, *J* = 7.4, 3H), 2.58 (s, 3H), 2.64 (s, 3H), 2.70 (q, *J* = 7.5, 2H), 3.78 (s, 3H), 5.40 (s, 2H), 6.93 (m, 7H), 7.01-7.38 (m, 15H), 7.40 (d, *J* = 8.5, 1H), 7.57 (m, 1H).

4-[4-[(5,7-Dimethyl-2-propyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-[2-(triphenylmethyl)-2*H*-tetrazol-5-yl]quinoline (6o). The title compound was prepared from **5b** and 5,7-dimethyl-2-propyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a white solid (0.45 g, 42%) melting at

170-171 °C. ¹H-NMR (CDCl₃): 0.92 (t, *J* = 7.3, 3H), 1.69 (m, 2H), 2.59 (s, 3H), 2.64 (s, 3H), 2.68 (t, *J* = 7.4, 2H), 5.41 (s, 2H), 6.93 (s, 7H), 7.04 (d, *J* = 8.2, 2H), 7.12 (d, *J* = 8.0, 2H), 7.29 (m, 9H), 7.44 (m, 2H), 7.72 (m, 1H), 8.17 (d, *J* = 8.5, 1H), 9.48 (s, 1H).

Ethyl 1-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-2-naphthalenecarboxylate (6a). The title compound was prepared from **5a** and 5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a white solid (0.30 g, 43%) melting at 147 °C. ¹H-NMR (CDCl₃): 0.92 (t, *J* = 7.4, 3H), 1.38 (t, *J* = 7.4, 3H), 2.61 (s, 3H), 2.64 (s, 3H), 2.89 (q, *J* = 7.5, 2H), 4.01 (q, *J* = 7.0, 2H), 5.56 (s, 2H), 6.90 (s, 1H), 7.24 (m, 4H), 7.45 (m, 3H), 7.87 (m, 3H). MS (EI): *m/z* 463 (M⁺, 100).

Ethyl 4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylate (6c). The title compound was prepared from **5c** and 5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a white solid (0.34 g, 49%) melting at 155 °C. ¹H-NMR: (CDCl₃): 0.97 (t, *J* = 7.3, 3H), 1.38 (t, *J* = 7.4, 3H), 2.60 (s, 3H), 2.64 (s, 3H), 2.88 (q, *J* = 7.5, 2H), 4.08 (q, *J* = 7.2, 2H), 5.56 (s, 2H), 6.91 (s, 1H), 7.25 (m, 4H), 7.47 (m, 2H), 7.76 (m, 1H), 8.16 (d, *J* = 8.5, 1H), 9.31 (s, 1H).

Ethyl 4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-2-methoxy-3-quinolinecarboxylate (6d). The title compound was prepared from **5d** and 5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridine and was further purified by recrystallization from methanol to obtain white crystals (0.28 g, 38%) melting at 182-183 °C. ¹H-NMR: (CDCl₃): 0.90 (t, *J* = 7.0, 3H), 1.34 (t, *J* = 7.4, 3H), 2.60 (s, 3H), 2.64 (s, 3H), 2.83 (q, *J* = 7.4, 2H), 4.03 (q, *J* = 7.2, 2H), 4.11 (s, 3H), 5.53 (s, 2H), 6.91 (s, 1H), 7.31 (m, 6H), 7.62 (m, 1H), 7.88 (d, *J* = 8.2, 1H).

Ethyl 2-Chloro-4-[4-[(5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylate (6x). The title compound was prepared from **5q** and 5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a white solid (0.44 g, 59%) melting at 153 °C. ¹H-NMR: (CDCl₃): 0.99 (t, *J* = 7.1, 3H), 1.35 (t, *J* = 7.7, 3H), 2.60 (s, 3H), 2.64 (s, 3H), 2.84 (q, *J* = 7.6, 2H),

4.09 (q, $J = 7.0$, 2H), 5.54 (s, 2H), 6.91 (s, 1H), 7.26 (m, 4H), 7.49 (m, 2H), 7.75 (m, 1H), 8.06 (d, $J = 8.4$, 1H).

Ethyl 2-Chloro-4-[4-[(5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolineacetate (6k). The title compound was prepared from **5k** and 5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a white solid (0.34 g, 44%) melting at 148 °C. ¹H-NMR: (CDCl₃): 1.19 (t, $J = 7.1$, 3H), 1.35 (t, $J = 7.5$, 3H), 2.60 (s, 3H), 2.63 (s, 3H), 2.86 (q, $J = 7.5$, 2H), 3.64 (s, 2H), 4.11 (q, $J = 7.1$, 2H), 5.55 (s, 2H), 6.91 (s, 1H), 7.18-7.44 (m, 6H), 7.67 (t, $J = 7.6$, 1H), 8.38 (d, $J = 8.4$, 1H).

Ethyl 1,2-Dihydro-4-[4-[(5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-1-methyl-2-oxo-3-quinolinecarboxylate (6m). The title compound was prepared from **5m** and 5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a white solid (0.39 g, 53%) melting at 182 °C. ¹H-NMR: (CDCl₃): 0.94 (t, $J = 7.3$, 3H), 1.32 (t, $J = 7.4$, 3H), 2.60 (s, 3H), 2.64 (s, 3H), 2.82 (q, $J = 7.5$, 2H), 3.77 (s, 3H), 4.05 (q, $J = 7.0$, 2H), 5.52 (s, 2H), 6.91 (s, 1H), 7.09-7.31 (m, 6H), 7.40 (d, $J = 8.5$, 1H), 7.59 (m, 1H).

Ethyl 4-[4-[(5,7-Dimethyl-2-propyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylate (6p). The title compound was prepared from **5c** and 5,7-dimethyl-2-propyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a white solid (0.38 g, 53%) melting at 175 °C. ¹H-NMR: (CDCl₃): 0.98 (m, 6H), 1.80 (m, 2H), 2.59 (s, 3H), 2.62 (s, 3H), 2.81 (t, $J = 7.6$, 2H), 4.08 (q, $J = 7.2$, 2H), 5.56 (s, 2H), 6.90 (s, 1H), 7.23 (m, 4H), 7.48 (m, 2H), 7.75 (m, 1H), 8.15 (d, $J = 8.5$, 1H), 9.31 (s, 1H). MS (EI): m/z 478 (M⁺, 100).

Ethyl 2-Chloro-4-[4-[(5,7-dimethyl-2-propyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylate (6q). This compound was prepared from **5q** and 5,7-dimethyl-2-propyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a white solid (0.39 g, 51%) melting at 193 °C and was recrystallized from ethyl acetate to obtain crystals suitable for X-ray diffraction studies. ¹H-NMR: (CDCl₃): 1.00 (t, $J = 7.4$, 6H), 1.81 (m, 2H), 2.60 (s, 3H), 2.63 (s, 3H), 2.78 (t, $J = 7.8$, 2H), 4.10 (q,

$J = 7.2$, 2H), 5.54 (s, 2H), 6.91 (s, 1H), 7.28 (m, 4H), 7.48 (m, 2H), 7.75 (m, 1H), 8.06 (d, $J = 8.5$, 1H).

Ethyl 4-[4-[(2-Butyl-5,7-dimethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylate (6v). This compound was prepared from **5c** and 2-butyl-5,7-dimethyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a white solid (0.34 g, 46%) melting at 161-162 °C ¹H-NMR: (CDCl₃): 0.97 (m, 6H), 1.44 (m, 2H), 1.78 (m, 2H), 2.60 (s, 3H), 2.64 (s, 3H), 2.85 (t, $J = 7.5$, 2H), 4.09 (q, $J = 7.0$, 2H), 5.57 (s, 2H), 6.90 (s, 1H), 7.25 (m, 4H), 7.46 (m, 2H), 7.75 (m, 1H), 8.16 (d, $J = 8.5$, 1H), 9.31 (s, 1H).

Ethyl 2-Chloro-4-[4-[(2-butyl-5,7-dimethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylate (6y). This compound was prepared from **5q** and 2-butyl-5,7-dimethyl-3*H*-imidazo[4,5-*b*]pyridine to obtain a pale brown solid (0.47 g, 59%) melting at 123-124 °C. ¹H-NMR: (CDCl₃): 0.97 (m, 6H), 1.42 (m, 2H), 1.75 (m, 2H), 2.60 (s, 3H), 2.63 (s, 3H), 2.81 (t, $J = 7.9$, 2H), 4.10 (q, $J = 7.0$, 2H), 5.54 (s, 2H), 6.91 (s, 1H), 7.27 (m, 4H), 7.48 (m, 2H), 7.75 (m, 1H), 8.06 (d, $J = 8.4$, 1H).

Ethyl 2-Amino-4-[4-[(5,7-dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylate (6e). A mixture of 2-chloroquinoline derivative **6x** (0.50 g, 1.0 mmol) in pyridine (25 mL) with ethyl glycinate hydrochloride (0.42 g, 3.0 mmol) was refluxed for 18 h. Then, the same amount of ethyl glycinate was added to the reaction mixture and the reflux was extended for further 18 h. The pyridine was removed under reduced pressure and the residue was partitioned between water and chloroform. The organic layer was thoroughly washed with water, dried under sodium sulfate and evaporated under reduced pressure. Purification of the residue by flash chromatography with ethyl acetate as the eluent gave pure 2-aminoquinoline derivative **6e** (0.26 g, yield 54%). ¹H-NMR: (CDCl₃): 0.69 (t, $J = 7.0$, 3H), 1.39 (t, $J = 7.5$, 3H), 2.60 (s, 3H), 2.64 (s, 3H), 2.87 (q, $J = 7.5$, 2H), 3.87 (q, $J = 7.0$, 2H), 5.54 (s, 2H), 5.82 (s, 2H), 6.91 (s, 1H), 7.08-7.27 (m, 6H), 7.59 (m, 2H).

The following compounds were prepared in similar ways.

Ethyl 2-Amino-4-[4-[(5,7-dimethyl-2-propyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylate (6t) was prepared from **6q** (0.62 g, 1.2 mmol) to give 0.31 g of pure **6t** (yield 52%, mp 173-174 °C). ¹H-NMR: (CDCl₃): 0.69 (t, *J* = 7.1, 3H), 1.02 (t, *J* = 7.3, 3H), 1.83 (m, 2H), 2.59 (s, 3H), 2.63 (s, 3H), 2.82 (q, *J* = 7.5, 2H), 3.88 (q, *J* = 7.1, 2H), 5.55 (s, 2H), 5.78 (s, 2H), 6.90 (s, 1H), 7.08-7.33 (m, 6H), 7.59 (m, 2H).

Ethyl 2-Amino-4-[4-[(2-butyl-5,7-dimethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolinecarboxylate (6w) was prepared from **6y** (0.69 g, 1.3 mmol) to give 0.27 g of pure **6t** (yield 41%, mp 143 °C). ¹H-NMR: (CDCl₃): 0.69 (t, *J* = 7.2, 3H), 0.94 (t, *J* = 7.3, 3H), 1.43 (m, 2H), 1.76 (m, 2H), 2.59 (s, 3H), 2.63 (s, 3H), 2.84 (t, *J* = 7.9, 2H), 3.88 (q, *J* = 7.2, 2H), 5.54 (s, 2H), 5.82 (s, 2H), 6.90 (s, 1H), 7.06-7.23 (m, 6H), 7.59 (m, 2H).

Ethyl 4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-2-methylamino-3-quinolinecarboxylate (6f). A mixture of 2-chloroquinoline derivative **6x** (0.50 g, 1.0 mmol) in ethanol (25 mL) with 2 mL of a 33% (8.0 M) solution of methylamine in ethanol was refluxed overnight. The volatile were removed under reduced pressure and the residue was partitioned between water and dichloromethane. The organic layer was washed with water, dried under sodium sulfate and evaporated under reduced pressure. Purification of the residue by recrystallization from diethyl ether gave yellow crystals of **6f** (0.40 g, yield 81%, mp 189 °C). ¹H-NMR (CDCl₃): 0.66 (t, *J* = 7.1, 3H), 1.39 (t, *J* = 7.6, 3H), 2.59 (s, 3H), 2.64 (s, 3H), 2.87 (q, *J* = 7.5, 2H), 3.12 (d, *J* = 4.7, 3H), 3.84 (q, *J* = 7.1, 2H), 5.53 (s, 2H), 6.53 (q, *J* = 4.7, 1H), 6.90 (s, 1H), 7.05 (m, 1H), 7.21 (m, 5H), 7.53 (m, 1H), 7.72 (d, *J* = 8.4, 1H).

Ethyl 4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-2-dimethylamino-3-quinolinecarboxylate (6g). To a solution of 2-chloroquinoline derivative **6x** (0.50 g, 1.0 mmol) in DMF (10 mL) was added a 40% solution of dimethylamine in water (10 mL) and the resulting mixture was refluxed for 8 h. The reaction mixture was then poured into ice-water

to give a precipitate which was collected by filtration, washed with water, and dried under reduced pressure. Purification of the solid by flash chromatography with ethyl acetate as the eluent gave pure **6g** (0.39 g, yield 77%, mp 153 °C). ¹H-NMR (CDCl₃): 0.85 (t, *J* = 7.3, 3H), 1.36 (t, *J* = 7.5, 3H), 2.60 (s, 3H), 2.64 (s, 3H), 2.85 (q, *J* = 7.6, 2H), 3.11 (s, 6H), 3.88 (q, *J* = 7.2, 2H), 5.53 (s, 2H), 6.90 (s, 1H), 7.05-7.25 (m, 6H), 7.54 (m, 1H), 7.75 (d, *J* = 8.4, 1H).

Ethyl 4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-2-propylamino-3-quinolinecarboxylate (6h). The title compound was obtained from 2-chloroquinoline derivative **6x** (0.50 g, 1.0 mmol) and propylamine (2 mL, 24 mmol) by means of the same procedure described for **6f** to obtain 0.48 g (yield 92%) of **6h** as a yellow glass. ¹H-NMR (CDCl₃): 0.66 (t, *J* = 7.0, 3H), 1.02 (t, *J* = 7.4, 3H), 1.39 (t, *J* = 7.6, 3H), 1.71 (m, 2H), 2.59 (s, 3H), 2.64 (s, 3H), 2.87 (q, *J* = 7.5, 2H), 3.56 (q, *J* = 6.5, 2H), 3.85 (q, *J* = 7.1, 2H), 5.53 (s, 2H), 6.56 (t, *J* = 5.0, 1H), 6.90 (s, 1H), 7.03 (m, 1H), 7.24 (m, 5H), 7.51 (m, 1H), 7.68 (d, *J* = 8.4, 1H).

Ethyl 4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-2-dipropylamino-3-quinolinecarboxylate (6i). The title compound was obtained from 2-chloroquinoline derivative **6x** (0.50 g, 1.0 mmol) and dipropylamine (2 mL, 14.6 mmol) by means of the same procedure (the refluxing time was extended to 5 days) described for **6f**. Compound **6i** was purified by flash chromatography with ethyl acetate as the eluent to obtain 0.47 g of yellow thick oil (yield 83%). ¹H-NMR (CDCl₃): 0.85 (m, 9H), 1.36 (t, *J* = 7.5, 3H), 1.63 (m, 4H), 2.60 (s, 3H), 2.64 (s, 3H), 2.84 (q, *J* = 7.4, 2H), 3.40 (t, *J* = 7.4, 4H), 3.86 (q, *J* = 7.2, 2H), 5.52 (s, 2H), 6.90 (s, 1H), 7.08-7.24 (m, 6H), 7.51 (m, 1H), 7.72 (d, *J* = 8.5, 1H).

Ethyl 4-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-quinolineacetate (6j). A mixture of **6k** (0.20 g, 0.39 mmol) in 20 mL of ethanol with triethylamine (0.5 mL) and 0.04 g of 10% Pd on carbon was hydrogenated for 5 h at atmospheric pressure and at room temperature. The catalyst was filtered off and the filtrate was evaporated under reduced pressure. The residue was partitioned between CH₂Cl₂ and water. The organic layer was washed with brine, dried over sodium sulfate and concentrated under reduced pressure. Purification of the

residue by flash chromatography with ethyl acetate as the eluent gave 0.12 g of **6j** as a colorless oil which crystallized on standing (yield 64%, mp 130-131 °C). ¹H-NMR: (CDCl₃): 1.16 (t, *J* = 7.2, 3H), 1.36 (t, *J* = 7.5, 3H), 2.62 (s, 3H), 2.65 (s, 3H), 2.87 (q, *J* = 7.5, 2H), 3.56 (s, 2H), 4.05 (q, *J* = 7.2, 2H), 5.56 (s, 2H), 6.92 (s, 1H), 7.18-7.45 (m, 6H), 7.66 (m, 1H), 8.12 (d, *J* = 8.4, 1H), 8.87 (s, 1H).

Ethyl

5-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl][1,2,3,4]tetrazolo[1,5-*a*]quinoline-4-carboxylate (6n**).** To a solution of 2-chloroquinoline derivative **6x** (0.38 g, 0.76 mmol) in DMF (20 mL) was added sodium azide (0.15 g, 2.3 mmol) and the resulting mixture was heated at 100 °C for 4 days. The reaction mixture was concentrated under reduced pressure and poured into ice-water to give a precipitate which was collected by filtration, washed with water, and dried under reduced pressure. Purification of the solid by flash chromatography with ethyl acetate as the eluent gave pure **6n** (0.21 g, yield 55%, mp 228-229 °C). Recrystallized of **6n** from ethyl acetate-dichloromethane gave crystals suitable for X-ray diffraction studies. ¹H-NMR: (CDCl₃): 1.02 (t, *J* = 7.3, 3H), 1.38 (t, *J* = 7.6, 3H), 2.60 (s, 3H), 2.64 (s, 3H), 2.87 (q, *J* = 7.6, 2H), 4.20 (q, *J* = 7.2, 2H), 5.57 (s, 2H), 6.92 (s, 1H), 7.33 (s, 4H), 7.59 (m, 2H), 7.91 (m, 1H), 8.77 (d, *J* = 8.3, 1H). MS (FAB): *m/z* 506 (M+1). Moreover, the filtrate was acidified with 1N HCl to obtain the precipitation of compound **4n**, which was collected by filtration, washed with water, and dried under reduced pressure (67 mg, 18%).

Ethyl 4-[4-[(5,7-Dimethyl-2-propyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-2-methyl-3-quinolinecarboxylate (6r**).** A mixture of **6q** (0.50 g, 0.97 mmol) in 20 mL of anhydrous DMF with Me₄Sn (0.14 mL, 1.0 mmol) was stirred at room temperature under argon for 15 min and was added Pd(PPh₃)₂Cl₂ (0.05 g, 0.07 mmol). The resulting mixture was heated at 120-130 °C under argon while 1.0 mL (7.2 mmol) of Me₄Sn was added in 15 min. After the addition was completed, the mixture was heated for 30 min more. The solvent was then removed under reduced pressure, and the residue was partitioned between CH₂Cl₂ and water. The organic layer was dried over sodium sulfate, and concentrated under reduced pressure. Purification of the residue by flash

chromatography with ethyl acetate as the eluent gave 0.36 g of **6r** (yield 75%) as a white crystalline solid: mp 160-161 °C. ¹H-NMR: (CDCl₃): 0.97 (m, 6H), 1.78 (m, 2H), 2.60 (s, 3H), 2.64 (s, 3H), 2.75 (s, 3H), 2.81 (t, *J* = 7.4, 2H), 4.02 (q, *J* = 7.0, 2H), 5.54 (s, 2H), 6.91 (s, 1H), 7.30 (m, 4H), 7.46 (m, 2H), 7.69 (m, 1H), 8.05 (d, *J* = 8.3, 1H).

Ethyl 1-(4-methylphenyl)-2-naphthalenecarboxylate (5a). A mixture of triflate **7²** (0.89 g, 2.6 mmol) in 20 mL of anhydrous DMF with *p*-tolylboronic acid (0.69 g, 5.1 mmol), LiCl (0.21 g, 5.1 mmol), sodium carbonate (0.28 g, 2.6 mmol), and palladium 5% wt. on activated carbon (0.045 g) was heated at 110-120 °C for 6 h under argon. The catalyst was filtered-off and the solvent was then removed under reduced pressure. The residue was partitioned between CH₂Cl₂ and water and the organic layer was washed with brine, dried over sodium sulfate and concentrated under reduced pressure. Purification of the residue by flash chromatography with *n*-hexane-ethyl acetate (8:2) as the eluent gave 0.45 g of **5a** (yield 60%) as a colorless oil which crystallized on standing (mp 68 °C). ¹H-NMR (CDCl₃): 0.99 (t, *J* = 7.1, 3H), 2.45 (s, 3H), 4.06 (q, *J* = 7.1, 2H), 7.22 (q, *J* = 7.9, 4H), 7.39 (m, 1H), 7.52 (m, 1H), 7.62 (m, 1H), 7.87 (m, 3H).

4-(4-Methylphenyl)-3-quinolinecarbonitrile (9). A mixture of **8³** (15 g, 71 mmol) in toluene (500 mL) with 3,3-dimethoxypropionitrile (15.8 mL, 141 mmol) and *p*-toluenesulfonic acid monohydrate (PTSA) (1.1 g, 5.0 mmol) was refluxed for 6 h while water was azeotropically removed using a Dean-Stark apparatus. Then, the reaction was washed with saturated NaHCO₃ solution, dried over sodium sulfate and evaporated under reduced pressure to give a crude product which was purified by flash chromatography with *n*-hexane-ethyl acetate (8:2) as the eluent to give 12 g of **9** (yield 69%) as a pale yellow solid (mp 88 °C). ¹H-NMR (CDCl₃): 2.49 (s, 3H), 7.40 (m, 4H), 7.59 (m, 1H), 7.83 (m, 2H), 8.20 (d, *J* = 8.2, 1H), 9.08 (s, 1H).

4-(4-Methylphenyl)-3-[2-(triphenylmethyl)-2H-tetrazol-5-yl]quinoline (5b). A mixture of **9** (3.7 g, 15 mmol) and trimethylstannylazide (6.0 g, 29 mmol) in dry xylene (200 mL) was heated at 115-120 °C for 30 h. The precipitate thus formed was collected by filtration, washed with boiling toluene and dried to obtain 6.7 g of white solid. To a suspension of this solid in CH₂Cl₂ (230 mL) and THF (60 mL) was added 10 N NaOH (1.5 mL, 15 mmol) and, after stirring for 15 min. at room temperature, was added triphenylmethylchloride (4.2 g, 15 mmol). The reaction mixture was stirred at room temperature for 3 h, diluted with H₂O, and extracted with CH₂Cl₂. The organic extracts were washed with H₂O and brine, dried over sodium sulfate and concentrated under reduced pressure. Purification of the residue by washing with diisopropyl ether gave **5b** as white crystals (7.2 g, 91%, mp 193 °C). ¹H-NMR (CDCl₃): 2.31 (s, 3H), 6.91 (d, *J* = 7.4, 6H), 7.05 (s, 4H), 7.26 (m, 9H), 7.47 (t, *J* = 7.9, 1H), 7.64 (d, *J* = 7.7, 1H), 7.74 (t, *J* = 7.7, 1H), 8.18 (d, *J* = 8.2, 1H), 9.48 (s, 1H).

Ethyl 1,2-Dihydro-4-(4-methylphenyl)-2-oxo-3-quinolinecarboxylate (10). To an ice-cooled mixture of **8** (1.5 g, 7.1 mmol) in CH₂Cl₂ (40 mL) was added dropwise ethylmalonylchloride (1.1 mL, 8.6 mmol) in CH₂Cl₂ (20 mL); the resulting mixture was stirred for 1 h at room temperature and cooled in an ice bath. To the reaction mixture was added a saturated NaHCO₃ solution (70 mL), the organic phase was separated, washed with saturated NaHCO₃ solution, dried over sodium sulfate and evaporated under reduced pressure to obtain 2.3 g of a yellow oil. To a solution of the oil in ethanol (50 mL) was added NaH (0.72 g, 30 mmol) and the mixture was refluxed for 2 h under argon. Then, the yellow reaction mixture was poured into ice, acidified with 2N HCl and the solid thus formed was collected by filtration and washed with ether and methanol to give 2.0 g of **10** (yield 92%). ¹H-NMR (CDCl₃): 1.01 (t, *J* = 7.1, 3H), 2.43 (s, 3H), 4.14 (q, *J* = 7.1, 2H), 7.12 (t, *J* = 7.3, 1H), 7.27 (m, 5H), 7.42 (d, *J* = 8.2, 1H), 7.53 (t, *J* = 7.2, 1H), 11.94 (br s, 1H).

Ethyl 2-Chloro-4-(4-methylphenyl)-3-quinolinecarboxylate (5q). A mixture of **10** (2.3 g, 7.5 mmol) in POCl_3 (8 mL) was refluxed for 1 h and poured into crushed ice. The precipitate formed was extracted with CHCl_3 , the combined extracts were washed with water, dried and concentrated under reduced pressure to give a crude product which, after purification by flash chromatography with *n*-hexane-ethyl acetate (8:2) as the eluent afforded 2.1 g of **5q** as white crystals (yield 86%, mp 135 °C). $^1\text{H-NMR}$ (CDCl_3): 1.07 (t, $J = 7.0$, 3H), 2.44 (s, 3H), 4.77 (q, $J = 7.0$, 2H), 7.27 (m, 4H), 7.50 (m, 1H), 7.63 (m, 1H), 7.76 (m, 1H), 8.07 (d, $J = 8.4$, 1H).

Ethyl 4-(4-Methylphenyl)-3-quinolinecarboxylate (5c). A mixture of **5q** (0.50 g, 1.5 mmol) in ethanol (30 mL) with triethylamine (2 mL) and Pd/C 10% (0.1 g) was stirred at room temperature under atmospheric pressure of H_2 for 3 h, filtered off and evaporated under reduced pressure. The residue was subjected to flash chromatography on silica gel (*n*-hexane-ethyl acetate, 8:2) to give **5c** in 48% yield (0.21 g, mp 111 °C). $^1\text{H-NMR}$ (CDCl_3): 1.05 (t, $J = 6.9$, 3H), 2.46 (s, 3H), 4.14 (q, $J = 7.0$, 2H), 7.18 (d, $J = 7.9$, 2H), 7.30 (d, $J = 7.9$, 2H), 7.48 (m, 1H), 7.64 (d, $J = 7.9$, 1H), 7.75 (m, 1H), 8.17 (d, $J = 8.4$, 1H), 9.31 (s, 1H).

Ethyl 2-Methoxy-4-(4-methylphenyl)-3-quinolinecarboxylate (5d). To a solution of **5q** (0.72 g, 2.2 mmol) in dry methanol (30 mL) was added a 30% sodium methylate solution (1.2 mL, 6.5 mmol). The reaction mixture was heated under reflux for 4 h, cooled to room temperature and the excess of sodium methylate was quenched with NH_4Cl . After evaporation of the solvent, the residue was diluted with water and extracted with CHCl_3 ; the combined extracts were washed with brine, dried and concentrated under reduced pressure. Purification of the residue by flash chromatography with *n*-hexane-ethyl acetate (8:2) gave 0.51 g of **5d** (72% yield). $^1\text{H-NMR}$ (CDCl_3): 0.98 (t, $J = 7.3$, 3H), 2.42 (s, 3H), 4.10 (m, 5H), 7.28 (m, 5H), 7.53 (d, $J = 7.9$, 1H), 7.63 (m, 1H), 7.88 (d, $J = 8.3$, 1H).

Ethyl 1,2-Dihydro-4-(4-methylphenyl)-1-methyl-2-oxo-3-quinolinecarboxylate (5m). To a solution of **10** (1.0 g, 3.25 mmol) in THF (15 mL) and DMF (28 mL) were added powder KOH (2.4 g, 43 mmol) and tetrabutylammonium bromide (0.4 g). The mixture was stirred for 10 min at room temperature and addition of methyl iodide (0.31 mL, 5.0 mmol). After stirring for 30 min. at room temperature, the mixture was poured into ice and the precipitate formed was extracted with CHCl_3 . The organic layer was washed with water, dried with sodium sulfate, and evaporated under reduced pressure. The residue was treated with diethyl ether and the solid was filtered-off. The filtrate was evaporated under reduced pressure and the residue was purified by flash chromatography (CH_2Cl_2 -ethyl acetate, 8:2) to obtain **5e** in 89% yield (0.93 g). $^1\text{H-NMR}$ (CDCl_3): 1.02 (t, $J = 7.2$, 3H), 2.42 (s, 3H), 3.78 (s, 3H), 4.10 (q, $J = 7.2$, 2H), 7.14 (m, 1H), 7.27 (m, 4H), 7.38 (m, 2H), 7.59 (m, 1H).

1,2-Dihydro-4-(4-methylphenyl)-1-methyl-2-oxo-3-quinolinecarbonitrile (11). A mixture of **5m** (0.97 g, 3.0 mmol) in ethanol (15 mL) and 2.5 N NaOH (10 mL) was heated overnight to reflux, cooled at room temperature, concentrated *in vacuo* to half the volume, and acidified with 1 N HCl. The precipitate was collected by filtration, washed with water and dried under reduced pressure to obtain a white solid. A mixture of this solid in SOCl_2 (10 mL) was refluxed for 1 h and the excess of SOCl_2 was removed under reduced pressure. The resulting residue was dissolved in CH_2Cl_2 (20 mL) and NH_3 was bubbled under vigorous stirring for 40 min. The reaction mixture was diluted with CH_2Cl_2 , washed with water, dried over sodium sulfate, and concentrated under reduced pressure. A mixture of the residue in dry benzene (20 mL) and POCl_3 (2.6 mL, 28 mmol) was heated to reflux for 7 h. The solvent was then removed, the residue was diluted with CH_2Cl_2 (20 mL), poured into a ice-cold saturated NaHCO_3 solution and stirred for 10 h. The organic layer was separated, dried and concentrated under reduced pressure to give a crude product which was purified by flash chromatography with CH_2Cl_2 -ethyl acetate (8:2) as the eluent to give 0.59 g of **11**

as a pale yellow solid (yield 72%, mp 251 °C). ¹H-NMR (CDCl₃): 2.46 (s, 3H), 3.81 (s, 3H), 7.17-7.48 (m, 7H), 7.69 (m, 1H).

1-Methyl-4-(4-methylphenyl)-3-[2-(triphenylmethyl)-2H-tetrazol-5-yl]-2(1H)quinolinone (5l).

This compound was prepared starting from **11** (0.50 g, 1.8 mmol) by means of the same procedure described for the preparation of **5b** and was obtained as white crystals (0.63 g, yield 63%, mp 194 °C). ¹H-NMR (CDCl₃): 2.33 (s, 3H), 3.80 (s, 3H), 6.92 (m, 6H), 7.15 (m, 5H), 7.29 (m, 10H), 7.42 (m, 1H), 7.59 (m, 1H).

Ethyl 1,2-Dihydro-4-(4-methylphenyl)-2-oxo-3-quinolineacetate (12). To an ice-cooled solution of **8** (2.2 g, 10 mmol) in CH₂Cl₂ (50 mL) was added dropwise ethylsuccinylchloride (1.6 mL, 11 mmol) in CH₂Cl₂ (20 mL). The resulting mixture was stirred for 1 h at room temperature and cooled to 0-5 °C. To the reaction mixture was added saturated NaHCO₃ solution (100 mL), the organic phase was separated, washed with saturated NaHCO₃ solution, dried over sodium sulfate and evaporated under reduced pressure to obtain a yellow oil. To a solution of the oil in ethanol (50 mL) was added NaH (1.0 g, 42 mmol) and the mixture was refluxed for 2 h under argon. Then, the yellow reaction mixture was poured into ice, acidified with 2N HCl and the solid formed was collected by filtration and washed with ether and dried to give 2.7 g of white solid. The solid was suspended in 70 mL of anhydrous ethanol and to this mixture was dropwise added POCl₃ (10 mL). After the addition was completed, the reaction mixture was allowed to cool to room temperature with vigorous stirring and the volatile was removed under reduced pressure. The residue was poured into ice-water and neutralized with 1N NaOH. The precipitate was collected by filtration, washed with water and diethyl ether in the sequence, and dried under reduced pressure to give 2.1 g of pure **12** (yield 65%). An analytical sample was recrystallized from ethyl acetate: mp 212 °C. ¹H-NMR (CDCl₃): 1.23 (t, *J* = 7.0, 3H), 2.45 (s, 3H), 3.50 (s, 2H), 4.14 (q, *J* = 7.2, 2H), 7.01-7.48 (m, 8H), 12.11 (br s, 1H).

Ethyl 2-Chloro-4-(4-methylphenyl)-3-quinolineacetate (5k). The title compound was prepared starting from **12** (2.1 g, 6.5 mmol) by using the same procedure described for the preparation of imidoyl chloride **5q** and was purified by flash chromatography with CH₂Cl₂ as the eluent to obtain 2.0 g of white crystals (yield 91%, mp 119 °C). ¹H-NMR (CDCl₃): 1.22 (t, *J* = 7.1, 3H), 2.46 (s, 3H), 3.71 (s, 2H), 4.15 (q, *J* = 7.0, 2H), 7.16 (d, *J* = 7.9, 2H), 7.32 (d, *J* = 7.9, 2H), 7.41 (m, 2H), 7.69 (m, 1H), 8.06 (d, *J* = 8.4, 1H).

2-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-(2*H*-tetrazol-5-yl)pyridine (2h). The reference compound **2h** was prepared in three steps (bromination, coupling, and deprotection) from **15** to obtain a white solid melting at 101-104 °C (yield 18%). ¹H-NMR (CDCl₃): 1.08 (t, *J* = 7.5, 3H), 2.42 (s, 3H), 2.55 (m, 5H), 5.35 (s, 2H), 6.89 (s, 1H), 6.94 (d, *J* = 8.0, 2H), 7.15 (d, *J* = 8.3, 2H), 7.44 (m, 1H), 8.28 (m, 1H), 8.75 (m, 1H). MS (FAB): *m/z* 411 (M+1).
Anal. (C₂₃H₂₂N₈) C, H, N.

2-(4-Methylphenyl)-3-[2-(triphenylmethyl)-2*H*-tetrazol-5-yl]pyridine (15). This compound was prepared starting from **14** (0.21 g, 1.1 mmol) by means of the same procedure described for the preparation of **5b** and was obtained as white solid (0.42 g, yield 80 %, mp 145 °C). ¹H-NMR (CDCl₃): 2.28 (s, 3H), 6.94 (m, 8H), 7.16-7.37 (m, 12H), 8.16 (m, 1H), 8.73 (m, 1H).

2-[4-[(5,7-Dimethyl-2-ethyl-3*H*-imidazo[4,5-*b*]pyridin-3-yl)methyl]phenyl]-3-pyridinecarboxylic Acid (2j). The title compound was prepared from nitrile derivative **16** (0.22 g, 0.6 mmol) by means of the basic hydrolysis procedure employing ethylene glycol as the solvent (14 mL) and 10% NaOH (10 mL) (reaction time 18 h) to obtain 0.13 g of white solid (yield 56%, mp 193-195 °C). ¹H-NMR (CDCl₃): 0.92 (t, *J* = 7.5, 3H), 2.52 (s, 3H), 2.57 (s, 3H), 2.67 (q, *J* = 7.6,

2H), 5.48 (s, 2H), 6.90 (s, 1H), 7.13 (d, $J = 8.2$, 2H), 7.32 (m, 1H), 7.55 (d, $J = 8.3$, 2H), 8.15 (m, 1H), 8.71 (m, 1H). MS (FAB): m/z 387 (M+1). Anal. ($C_{23}H_{22}N_4O_2 \cdot 0.5H_2O$) C, H, N.

2-[4-[(5,7-Dimethyl-2-ethyl-3H-imidazo[4,5-b]pyridin-3-yl)methyl]phenyl]-3-pyridinecarbonitrile (16). The title compound was prepared from nitrile derivative **14** (0.20 g, 1.0 mmol) by means of the bromination-coupling procedure and was obtained as white solid (0.13 g, yield 35%, mp 154-156 °C). 1H -NMR ($CDCl_3$): 1.30 (t, $J = 7.5$, 3H), 2.56 (s, 3H), 2.62 (s, 3H), 2.76 (q, $J = 7.5$, 2H), 5.51 (s, 2H), 6.87 (s, 1H), 7.24 (d, $J = 8.1$, 2H), 7.32 (m, 1H), 7.83 (d, $J = 8.1$, 2H), 8.02 (m, 1H), 8.81 (m, 1H).

2-(4-methylphenyl)-3-pyridinecarbonitrile (14). A mixture of 2-chloro-3-pyridinecarbonitrile (**13**) (Lancaster) (0.14 g, 1.0 mmol) in 10 mL of anhydrous DMF with *p*-tolylboronic acid (0.27 g, 2.0 mmol), potassium carbonate (0.14 g, 1.0 mmol), and $Pd(PPh_3)_2Cl_2$ (0.14 g, 0.2 mmol) was heated at 90 °C for 18 h under argon. The solvent was then removed under reduced pressure, the residue was partitioned between CH_2Cl_2 and water and the organic layer was washed with brine, dried over sodium sulfate and concentrated under reduced pressure. Purification of the residue by flash chromatography with *n*-hexane-ethyl acetate (65:35) as the eluent gave 0.14 g of **14** (yield 72%) as white solid (mp 83 °C). 1H -NMR ($CDCl_3$): 2.43 (s, 3H), 7.33 (m, 3H), 7.84 (d, $J = 8.0$, 2H), 8.05 (m, 1H), 8.85 (m, 1H). MS (EI): m/z 194 (M^+ , 100).

Table 1S. Crystal Data for Compounds 4d and 6n,q.

compd	4d	6n	6q
Formula	$C_{28}H_{26}N_4O_3 \cdot 0.5$ $H_2O \cdot 0.5 C_2H_5OH$	$C_{29}H_{27}N_7O_2$	$C_{30}H_{29}ClN_4O_2$
MW	498.57	505.58	513.02
Crystal System	Triclinic	Triclinic	Triclinic
Space Group	P-1 (n. 2)	P-1 (n. 2)	P-1 (n. 2)
a/Å	13.641(4)	8.515(3)	9.311(1)
b/Å	14.136(1)	9.849(2)	9.917(1)
c/Å	14.302(1)	15.826(4)	15.653(1)
$\alpha/^\circ$	72.61(1)	95.45(1)	104.30(1)
$\beta/^\circ$	83.37(1)	99.24(2)	105.96(1)
$\gamma/^\circ$	88.93(1)	104.56(3)	97.04(1)
U/Å ³	2613.8(8)	1255.2(6)	1318.1(2)
Temperature /K	293(2)	293(2)	293(2)
Z	4	2	2
F(000)	1056	532	540
$D_c/g\text{ cm}^{-3}$	1.267	1.338	1.293
$\mu(\text{Mo-K}\alpha)/\text{mm}^{-1}$	0.086	0.088	0.180
Scan mode	$\omega/2\theta$	$\omega/2\theta$	$\omega/2\theta$
Scan range/ $^\circ$	$1 \leq \theta \leq 25$	$1 \leq \theta \leq 25$	$1 \leq \theta \leq 25$
Scan width/ $^\circ$	1.26	1.00	0.92
Scan speed/ $^\circ\text{ min}^{-1}$	3	3	3
Independent reflections	6757	4409	4569
Obs. reflections ($I > 2\sigma(I)$)	5255	1943	3715
N. parameters refined	712	373	355
R_1 ($I > 2\sigma(I)$)	0.046	0.070	0.044
wR_2 ($I > 2\sigma(I)$)	0.112	0.133	0.113

Table 2S. Atomic coordinates ($\times 10^4$) and equivalent isotropic displacement parameters ($\text{\AA}^2 \times 10^3$) for compounds **4d**, **6n** and **6q**.
 $U(\text{eq})$ is defined as one third of the trace of the orthogonalized U_{ij} tensor.

4d

	x	y	z	U(eq)
N(1)	7488(2)	10279(2)	18(2)	64(1)
C(2)	7113(2)	9642(2)	833(2)	57(1)
C(3)	6261(2)	9800(2)	1433(2)	50(1)
C(4)	5752(2)	10659(2)	1138(2)	49(1)
C(5)	6133(2)	11388(2)	237(2)	53(1)
C(6)	5685(2)	12309(2)	-140(2)	67(1)
C(7)	6105(3)	12985(2)	-989(2)	81(1)
C(8)	6973(3)	12766(3)	-1480(2)	87(1)
C(9)	7415(2)	11883(3)	-1154(2)	78(1)
C(10)	7009(2)	11161(2)	-284(2)	60(1)
C(11)	2139(2)	11177(2)	3509(2)	60(1)
N(12)	1574(1)	10256(1)	4025(2)	53(1)
C(13)	1569(2)	9678(2)	4984(2)	54(1)
N(14)	964(2)	8902(1)	5200(2)	54(1)
C(15)	551(2)	8971(2)	4333(2)	50(1)
C(16)	-130(2)	8375(2)	4106(2)	55(1)
C(17)	-342(2)	8696(2)	3138(2)	68(1)
C(18)	86(2)	9553(2)	2444(2)	70(1)
N(19)	729(2)	10139(2)	2668(2)	64(1)
C(20)	931(2)	9811(2)	3597(2)	52(1)
C(21)	-620(2)	7473(2)	4845(2)	69(1)
C(22)	-165(3)	9863(3)	1402(2)	104(1)
C(23)	2209(2)	9907(2)	5668(2)	74(1)
C(24)	2138(3)	9189(3)	6687(3)	97(1)
C(25)	5909(2)	8960(2)	2332(2)	53(1)
O(26)	6161(2)	8867(2)	3128(2)	82(1)
O(27)	5308(1)	8371(1)	2118(1)	64(1)
O(28)	7520(1)	8738(1)	1178(1)	73(1)
C(29)	8161(2)	8383(3)	522(2)	89(1)
C(1')	4826(2)	10810(2)	1736(2)	49(1)
C(2')	4842(2)	10908(2)	2669(2)	60(1)
C(3')	3979(2)	11023(2)	3233(2)	61(1)
C(4')	3076(2)	11028(2)	2890(2)	53(1)
C(5')	3053(2)	10919(2)	1967(2)	67(1)
C(6')	3915(2)	10817(2)	1399(2)	65(1)
N(1A)	1554(2)	5030(2)	9300(2)	56(1)
C(2A)	1529(2)	5734(2)	8469(2)	51(1)
C(3A)	873(2)	5760(2)	7758(2)	45(1)
C(4A)	201(2)	5001(2)	7951(2)	44(1)
C(5A)	180(2)	4221(2)	8862(2)	49(1)
C(6A)	-502(2)	3420(2)	9149(2)	61(1)
C(7A)	-507(2)	2709(2)	10035(2)	69(1)
C(8A)	163(2)	2768(2)	10681(2)	72(1)
C(9A)	837(2)	3526(2)	10426(2)	65(1)
C(10A)	860(2)	4273(2)	9517(2)	52(1)
C(11A)	-2657(2)	4983(2)	5246(2)	46(1)
N(12A)	-3584(1)	4475(1)	5767(1)	42(1)
C(13A)	-3761(2)	3474(2)	6104(2)	46(1)
N(14A)	-4660(1)	3255(1)	6565(1)	49(1)
C(15A)	-5097(2)	4160(2)	6545(2)	46(1)
C(16A)	-6029(2)	4395(2)	6913(2)	53(1)
C(17A)	-6175(2)	5395(2)	6749(2)	60(1)

C(18A)	-5460(2)	6114(2)	6260(2)	57(1)
N(19A)	-4561(1)	5892(1)	5892(1)	50(1)
C(20A)	-4427(2)	4924(2)	6052(2)	42(1)
C(21A)	-6803(2)	3625(2)	7459(3)	82(1)
C(22A)	-5651(2)	7195(2)	6136(3)	84(1)
C(23A)	-3003(2)	2752(2)	5948(2)	61(1)
C(24A)	-3338(2)	1677(2)	6356(2)	83(1)
C(25A)	992(2)	6581(2)	6805(2)	47(1)
O(26A)	1451(1)	6469(1)	6075(1)	69(1)
O(27A)	562(1)	7407(1)	6845(1)	60(1)
O(28A)	2167(1)	6516(1)	8206(1)	64(1)
C(29A)	2848(2)	6571(3)	8878(2)	89(1)
C(1'A)	-520(2)	4996(2)	7245(2)	43(1)
C(2'A)	-1377(2)	5517(2)	7245(2)	72(1)
C(3'A)	-2061(2)	5513(2)	6606(2)	67(1)
C(4'A)	-1908(2)	4989(2)	5947(2)	41(1)
C(5'A)	-1048(2)	4485(2)	5929(2)	72(1)
C(6'A)	-365(2)	4488(2)	6571(2)	76(1)
OW1	-3206(2)	7617(2)	4895(2)	96(1)
CE1	4247(4)	3858(5)	1522(4)	178(2)
CE2	3629(7)	4023(10)	875(8)	260(5)
OE1A ^a	3493(6)	3982(8)	88(8)	195(4)
OE1B ^b	2984(9)	4647(8)	776(7)	148(6)

^a site occupancy factor equal to 0.62(1)

^b site occupancy factor equal to 0.38(1)

6n

	x	y	z	U(eq)
N(1)	-2916(4)	4062(4)	11118(2)	56(1)
C(2)	-2812(6)	4879(5)	10479(3)	57(1)
C(3)	-2500(6)	4330(5)	9671(3)	54(1)
C(4)	-2506(5)	2949(4)	9534(3)	49(1)
C(5)	-2724(5)	2064(4)	10222(3)	49(1)
C(6)	-2765(6)	634(5)	10111(3)	62(1)
C(7)	-2917(6)	-158(5)	10782(3)	72(1)
C(8)	-2989(6)	486(6)	11586(3)	77(2)
C(9)	-2980(6)	1875(5)	11711(3)	68(1)
C(10)	-2875(5)	2648(5)	11026(3)	55(1)
C(11)	-1581(5)	676(5)	6200(3)	55(1)
N(12)	-58(4)	309(4)	6162(2)	50(1)
C(13)	1446(6)	1166(4)	6095(2)	48(1)
N(14)	2581(4)	485(3)	6017(2)	50(1)
C(15)	1758(5)	-919(4)	6031(2)	46(1)
C(16)	2298(6)	-2135(5)	5959(3)	57(1)
C(17)	1115(7)	-3379(5)	6006(3)	65(1)
C(18)	-472(7)	-3398(5)	6121(3)	65(1)
N(19)	-1020(5)	-2229(4)	6185(2)	61(1)
C(20)	137(6)	-1059(4)	6132(2)	49(1)
C(21)	4017(6)	-2099(5)	5842(3)	78(2)
C(22)	-1685(7)	-4769(5)	6192(4)	95(2)
C(23)	1729(6)	2724(4)	6115(3)	58(1)
C(24)	3457(6)	3484(5)	6048(4)	78(2)
C(25)	-2003(9)	5330(6)	9042(4)	70(2)
O(26A) ^a	-1066(19)	5132(12)	8568(8)	108(6)
O(27A) ^a	-2456(15)	6486(9)	9147(5)	110(4)
C(28A) ^a	-1831(11)	7611(7)	8667(6)	149(9)

C(29A) ^a	-3164(13)	7726(11)	8002(7)	126(6)
O(26B) ^b	-763(17)	5539(18)	8803(13)	69(4)
O(27B) ^b	-3294(15)	5816(14)	8741(10)	107(6)
C(28B) ^b	-3147(15)	6688(17)	8029(10)	127(8)
C(29B) ^b	-1780(20)	7972(12)	8411(14)	156(14)
N(30)	-2950(5)	6138(4)	10785(3)	74(1)
N(31)	-3152(6)	6044(5)	11611(3)	83(1)
N(32)	-3127(6)	4814(5)	11831(3)	80(1)
C(1')	-2268(5)	2322(4)	8689(3)	47(1)
C(2')	-3445(6)	2165(4)	7950(3)	54(1)
C(3')	-3205(6)	1626(4)	7158(3)	53(1)
C(4')	-1778(5)	1229(4)	7086(3)	46(1)
C(5')	-611(5)	1381(4)	7827(3)	55(1)
C(6')	-853(6)	1902(5)	8621(3)	57(1)

^a site occupancy factor equal to 0.60(1)

^b site occupancy factor equal to 0.40(1)

6q

	x	y	z	U(eq)
C1	2989(1)	8741(1)	9431(1)	86(1)
N(1)	5064(2)	7479(2)	10154(1)	51(1)
C(2)	3781(2)	7813(2)	10189(1)	49(1)
C(3)	2975(2)	7506(2)	10785(1)	43(1)
C(4)	3615(2)	6814(2)	11407(1)	40(1)
C(5)	5024(2)	6399(2)	11395(1)	41(1)
C(6)	5776(2)	5661(2)	11990(1)	49(1)
C(7)	7103(2)	5270(2)	11924(2)	59(1)
C(8)	7748(2)	5597(2)	11270(2)	60(1)
C(9)	7069(2)	6323(2)	10697(1)	53(1)
C(10)	5699(2)	6742(2)	10746(1)	44(1)
C(11)	633(2)	5666(2)	14028(1)	47(1)
N(12)	1716(2)	5950(2)	14955(1)	46(1)
C(13)	2712(2)	5126(2)	15270(1)	48(1)
N(14)	3660(2)	5753(2)	16108(1)	54(1)
C(15)	3297(2)	7078(2)	16365(1)	51(1)
C(16)	3963(2)	8230(2)	17162(1)	59(1)
C(17)	3300(3)	9409(2)	17153(2)	66(1)
C(18)	2085(3)	9446(2)	16413(2)	65(1)
N(19)	1449(2)	8341(2)	15636(1)	58(1)
C(20)	2100(2)	7221(2)	15656(1)	48(1)
C(21)	5300(3)	8178(3)	17928(2)	76(1)
C(22)	1407(4)	10746(3)	16432(2)	94(1)
C(23)	2667(3)	3670(2)	14694(1)	59(1)
C(24)	3770(3)	2917(3)	15191(2)	75(1)
C(25)	3662(4)	1421(3)	14612(2)	93(1)
C(26)	1438(2)	7869(2)	10702(1)	48(1)
O(27)	279(2)	7130(2)	10169(1)	81(1)
O(28)	1534(2)	9090(2)	11305(1)	66(1)
C(29)	105(3)	9525(3)	11336(2)	85(1)
C(30)	454(3)	10866(3)	12040(2)	110(1)
C(1')	2845(2)	6504(2)	12078(1)	40(1)
C(2')	2933(3)	7566(2)	12862(1)	55(1)
C(3')	2218(3)	7298(2)	13483(1)	55(1)
C(4')	1402(2)	5953(2)	13339(1)	40(1)

C(5')	1307(2)	4901(2)	12554(1)	50(1)
C(6')	2019(2)	5169(2)	11929(1)	51(1)

Table 3S. Anisotropic displacement parameters ($\text{Å}^2 \times 10^3$) for compounds **4d**, **6n** and **6q**. The anisotropic displacement factor exponent takes the form:
 $-2 \pi^2 [h^2 a^2 U_{11} + \dots + 2 h k a b U_{12}]$

4d

	U11	U22	U33	U23	U13	U12
N(1)	55(1)	77(2)	59(1)	-18(1)	4(1)	-15(1)
C(2)	48(2)	63(2)	59(2)	-19(1)	1(1)	-12(1)
C(3)	49(1)	51(2)	49(1)	-14(1)	-1(1)	-15(1)
C(4)	50(1)	49(2)	48(1)	-16(1)	-4(1)	-15(1)
C(5)	62(2)	51(2)	47(2)	-14(1)	-8(1)	-18(1)
C(6)	83(2)	59(2)	56(2)	-13(1)	-12(2)	-13(2)
C(7)	109(3)	64(2)	62(2)	-4(2)	-17(2)	-20(2)
C(8)	105(3)	86(3)	56(2)	-1(2)	-1(2)	-37(2)
C(9)	82(2)	88(2)	55(2)	-12(2)	4(2)	-26(2)
C(10)	61(2)	68(2)	48(2)	-15(1)	0(1)	-26(2)
C(11)	61(2)	43(1)	75(2)	-16(1)	2(1)	-5(1)
N(12)	50(1)	45(1)	61(1)	-13(1)	5(1)	-4(1)
C(13)	52(2)	46(2)	65(2)	-21(1)	3(1)	2(1)
N(14)	53(1)	48(1)	59(1)	-17(1)	2(1)	-1(1)
C(15)	44(1)	46(1)	59(2)	-16(1)	0(1)	2(1)
C(16)	45(1)	50(2)	66(2)	-14(1)	1(1)	1(1)
C(17)	60(2)	69(2)	72(2)	-16(2)	-11(2)	-11(1)
C(18)	62(2)	77(2)	64(2)	-11(2)	-8(1)	-7(2)
N(19)	58(1)	63(1)	64(2)	-9(1)	-7(1)	-3(1)
C(20)	42(1)	47(1)	63(2)	-13(1)	-1(1)	0(1)
C(21)	58(2)	61(2)	79(2)	-10(2)	-3(1)	-12(1)
C(22)	105(3)	116(3)	79(2)	-3(2)	-28(2)	-31(2)
C(23)	85(2)	71(2)	72(2)	-27(2)	-8(2)	-13(2)
C(24)	103(3)	95(2)	95(3)	-25(2)	-31(2)	-14(2)
C(25)	48(2)	50(2)	61(2)	-18(1)	0(1)	-5(1)
O(26)	109(2)	74(1)	59(1)	-6(1)	-23(1)	-21(1)
O(27)	66(1)	55(1)	65(1)	-12(1)	1(1)	-20(1)
O(28)	61(1)	69(1)	82(1)	-18(1)	9(1)	4(1)
C(29)	80(2)	93(2)	93(2)	-32(2)	10(2)	3(2)
C(1')	54(2)	40(1)	51(2)	-13(1)	-3(1)	-11(1)
C(2')	52(2)	70(2)	66(2)	-31(1)	-7(1)	-9(1)
C(3')	61(2)	67(2)	63(2)	-32(1)	-2(1)	-11(1)
C(4')	53(2)	39(1)	62(2)	-13(1)	1(1)	-9(1)
C(5')	51(2)	84(2)	61(2)	-14(2)	-9(1)	-10(1)
C(6')	62(2)	86(2)	50(2)	-23(1)	-4(1)	-16(2)
N(1A)	56(1)	67(1)	52(1)	-24(1)	-14(1)	8(1)
C(2A)	45(1)	61(2)	52(2)	-25(1)	-7(1)	2(1)
C(3A)	40(1)	56(2)	43(1)	-21(1)	-4(1)	2(1)
C(4A)	42(1)	51(1)	43(1)	-19(1)	-5(1)	5(1)
C(5A)	47(1)	54(2)	46(1)	-18(1)	-4(1)	6(1)
C(6A)	57(2)	64(2)	57(2)	-14(1)	-4(1)	-1(1)
C(7A)	74(2)	63(2)	61(2)	-10(2)	3(2)	-3(2)
C(8A)	94(2)	68(2)	47(2)	-9(1)	-1(2)	11(2)
C(9A)	79(2)	73(2)	46(2)	-21(2)	-13(1)	13(2)
C(10A)	55(2)	59(2)	45(2)	-20(1)	-3(1)	9(1)
C(11A)	43(1)	48(2)	44(1)	-11(1)	-2(1)	-8(1)
N(12A)	38(1)	42(1)	46(1)	-13(1)	-3(1)	-4(1)
C(13A)	47(1)	42(1)	47(1)	-14(1)	0(1)	-3(1)
N(14A)	46(1)	43(1)	56(1)	-13(1)	5(1)	-4(1)
C(15A)	45(1)	45(1)	49(1)	-16(1)	-6(1)	-2(1)

C(16A)	44(1)	58(2)	59(2)	-21(1)	-4(1)	0(1)
C(17A)	44(1)	68(2)	77(2)	-35(2)	-9(1)	8(1)
C(18A)	54(2)	54(2)	72(2)	-29(1)	-20(1)	9(1)
N(19A)	51(1)	44(1)	60(1)	-19(1)	-16(1)	0(1)
C(20A)	41(1)	43(1)	47(1)	-17(1)	-10(1)	-2(1)
C(21A)	54(2)	79(2)	104(2)	-25(2)	19(2)	-6(2)
C(22A)	77(2)	60(2)	127(3)	-43(2)	-24(2)	14(2)
C(23A)	57(2)	51(2)	72(2)	-21(1)	11(1)	0(1)
C(24A)	86(2)	45(2)	107(2)	-18(2)	24(2)	8(2)
C(25A)	38(1)	57(2)	50(2)	-21(1)	-4(1)	-3(1)
O(26A)	75(1)	74(1)	54(1)	-21(1)	17(1)	8(1)
O(27A)	70(1)	56(1)	52(1)	-16(1)	3(1)	5(1)
O(28A)	53(1)	77(1)	66(1)	-25(1)	-14(1)	-11(1)
C(29A)	71(2)	111(3)	99(2)	-42(2)	-30(2)	-16(2)
C(1'A)	40(1)	47(1)	43(1)	-14(1)	-1(1)	-2(1)
C(2'A)	56(2)	104(2)	85(2)	-67(2)	-22(2)	20(2)
C(3'A)	49(2)	89(2)	86(2)	-55(2)	-23(1)	21(1)
C(4'A)	39(1)	43(1)	39(1)	-11(1)	1(1)	-7(1)
C(5'A)	59(2)	109(2)	74(2)	-63(2)	-17(2)	21(2)
C(6'A)	52(2)	114(2)	88(2)	-65(2)	-24(2)	33(2)
OW1	95(2)	73(1)	105(2)	4(1)	-36(1)	-19(1)
CE1	172(5)	232(7)	147(5)	-66(4)	-71(4)	84(5)
CE2	234(9)	381(14)	214(10)	-129(9)	-137(8)	160(9)
OE1A	178(6)	252(9)	183(8)	-100(8)	-57(6)	55(7)
OE1B	153(10)	163(10)	127(8)	-32(6)	-55(6)	22(6)

6n

	U11	U22	U33	U23	U13	U12
N(1)	63(3)	59(2)	51(2)	3(2)	18(2)	22(2)
C(2)	64(3)	54(3)	58(3)	9(2)	13(3)	20(2)
C(3)	63(3)	58(3)	49(3)	16(2)	17(2)	24(2)
C(4)	50(3)	55(3)	46(3)	8(2)	11(2)	17(2)
C(5)	54(3)	53(3)	46(3)	10(2)	14(2)	23(2)
C(6)	73(4)	62(3)	59(3)	11(2)	18(3)	28(3)
C(7)	75(4)	65(3)	86(4)	30(3)	21(3)	28(3)
C(8)	82(4)	93(4)	70(4)	40(3)	22(3)	32(3)
C(9)	78(4)	85(4)	51(3)	19(3)	18(3)	30(3)
C(10)	55(3)	67(3)	50(3)	15(2)	14(2)	23(2)
C(11)	51(3)	66(3)	48(3)	4(2)	11(2)	20(2)
N(12)	54(3)	53(2)	48(2)	3(2)	15(2)	21(2)
C(13)	57(3)	51(3)	39(2)	7(2)	10(2)	19(2)
N(14)	56(2)	49(2)	48(2)	6(2)	11(2)	21(2)
C(15)	55(3)	46(3)	39(2)	8(2)	5(2)	17(2)
C(16)	66(3)	60(3)	50(3)	8(2)	8(2)	28(3)
C(17)	90(4)	51(3)	59(3)	11(2)	13(3)	28(3)
C(18)	89(4)	51(3)	53(3)	6(2)	22(3)	13(3)
N(19)	72(3)	57(2)	52(2)	4(2)	21(2)	10(2)
C(20)	59(3)	51(3)	40(2)	5(2)	15(2)	17(2)
C(21)	80(4)	66(3)	96(4)	9(3)	13(3)	36(3)
C(22)	114(5)	63(3)	105(4)	15(3)	45(4)	1(3)
C(23)	79(4)	51(3)	51(3)	8(2)	13(2)	30(3)
C(24)	76(4)	46(3)	116(4)	17(3)	18(3)	20(3)
C(25)	96(5)	64(4)	59(4)	18(3)	25(3)	33(4)
O(26A)	183(14)	57(6)	101(9)	19(5)	77(8)	30(7)
O(27A)	199(12)	85(6)	93(6)	47(5)	70(7)	84(7)

29SI

C(28A)	270(30)	101(11)	119(12)	89(10)	80(13)	78(15)
C(29A)	78(9)	121(10)	187(14)	100(10)	27(9)	14(8)
O(26B)	50(7)	76(11)	87(10)	26(8)	24(7)	16(7)
O(27B)	106(11)	117(11)	136(13)	86(10)	40(9)	65(9)
C(28B)	133(17)	78(12)	180(20)	79(14)	31(16)	33(12)
C(29B)	250(40)	160(20)	140(20)	106(19)	120(30)	110(20)
N(30)	89(3)	59(3)	78(3)	2(2)	27(3)	25(2)
N(31)	99(4)	75(3)	79(3)	-6(2)	36(3)	27(3)
N(32)	103(4)	77(3)	64(3)	-4(2)	32(3)	28(3)
C(1')	56(3)	48(2)	43(3)	8(2)	14(2)	20(2)
C(2')	53(3)	60(3)	54(3)	6(2)	14(2)	25(2)
C(3')	56(3)	60(3)	48(3)	7(2)	7(2)	26(2)
C(4')	52(3)	47(2)	43(3)	7(2)	13(2)	20(2)
C(5')	48(3)	70(3)	53(3)	12(2)	10(2)	25(2)
C(6')	63(3)	76(3)	40(3)	7(2)	11(2)	34(3)

6q

	U11	U22	U33	U23	U13	U12
C1	88(1)	126(1)	93(1)	79(1)	50(1)	54(1)
N(1)	52(1)	57(1)	51(1)	20(1)	25(1)	13(1)
C(2)	53(1)	56(1)	48(1)	23(1)	21(1)	14(1)
C(3)	44(1)	46(1)	41(1)	12(1)	17(1)	10(1)
C(4)	43(1)	41(1)	35(1)	7(1)	14(1)	6(1)
C(5)	42(1)	40(1)	37(1)	6(1)	13(1)	5(1)
C(6)	50(1)	52(1)	45(1)	14(1)	15(1)	12(1)
C(7)	53(1)	65(1)	61(1)	22(1)	13(1)	20(1)
C(8)	44(1)	70(1)	67(1)	15(1)	19(1)	18(1)
C(9)	44(1)	60(1)	56(1)	10(1)	24(1)	8(1)
C(10)	42(1)	44(1)	41(1)	7(1)	15(1)	5(1)
C(11)	47(1)	56(1)	40(1)	15(1)	17(1)	8(1)
N(12)	54(1)	49(1)	36(1)	13(1)	19(1)	8(1)
C(13)	55(1)	51(1)	41(1)	17(1)	20(1)	10(1)
N(14)	60(1)	60(1)	42(1)	16(1)	16(1)	10(1)
C(15)	57(1)	55(1)	41(1)	13(1)	22(1)	2(1)
C(16)	62(1)	63(1)	46(1)	8(1)	23(1)	-6(1)
C(17)	79(2)	56(1)	55(1)	0(1)	30(1)	-6(1)
C(18)	86(2)	51(1)	63(1)	11(1)	39(1)	9(1)
N(19)	72(1)	54(1)	56(1)	17(1)	31(1)	14(1)
C(20)	58(1)	49(1)	42(1)	13(1)	26(1)	7(1)
C(21)	65(1)	89(2)	53(1)	3(1)	13(1)	-8(1)
C(22)	132(3)	62(2)	91(2)	13(1)	47(2)	28(2)
C(23)	73(2)	57(1)	49(1)	14(1)	20(1)	19(1)
C(24)	88(2)	60(1)	74(2)	20(1)	15(1)	24(1)
C(25)	112(2)	67(2)	100(2)	22(2)	25(2)	37(2)
C(26)	47(1)	54(1)	43(1)	14(1)	17(1)	11(1)
O(27)	48(1)	88(1)	81(1)	-11(1)	12(1)	11(1)
O(28)	49(1)	58(1)	78(1)	2(1)	15(1)	18(1)
C(29)	55(1)	84(2)	101(2)	-2(2)	17(1)	31(1)
C(30)	80(2)	107(2)	127(3)	-4(2)	32(2)	38(2)
C(1')	40(1)	45(1)	37(1)	13(1)	15(1)	11(1)
C(2')	75(1)	40(1)	51(1)	8(1)	32(1)	1(1)
C(3')	78(1)	45(1)	43(1)	5(1)	32(1)	7(1)
C(4')	41(1)	46(1)	35(1)	14(1)	14(1)	11(1)
C(5')	58(1)	44(1)	46(1)	8(1)	22(1)	-1(1)
C(6')	63(1)	46(1)	42(1)	2(1)	26(1)	4(1)

Table 4S. Bond lengths [Å] and angles [deg] for non-hydrogen atoms for compounds **4d**, **6n** and **6q**.**4d**

N(1)-C(2)	1.297(3)
N(1)-C(10)	1.372(4)
C(2)-O(28)	1.358(3)
C(2)-C(3)	1.418(3)
C(3)-C(4)	1.366(3)
C(3)-C(25)	1.503(3)
C(4)-C(5)	1.436(3)
C(4)-C(1')	1.491(3)
C(5)-C(6)	1.409(4)
C(5)-C(10)	1.417(4)
C(6)-C(7)	1.372(4)
C(7)-C(8)	1.384(5)
C(8)-C(9)	1.353(5)
C(9)-C(10)	1.414(4)
C(11)-N(12)	1.472(3)
C(11)-C(4')	1.517(3)
N(12)-C(13)	1.369(3)
N(12)-C(20)	1.385(3)
C(13)-N(14)	1.323(3)
C(13)-C(23)	1.491(4)
N(14)-C(15)	1.398(3)
C(15)-C(16)	1.392(3)
C(15)-C(20)	1.391(3)
C(16)-C(17)	1.385(4)
C(16)-C(21)	1.501(3)
C(17)-C(18)	1.402(4)
C(18)-N(19)	1.345(4)
C(18)-C(22)	1.502(4)
N(19)-C(20)	1.328(3)
C(23)-C(24)	1.501(4)
C(25)-O(26)	1.196(3)
C(25)-O(27)	1.301(3)
O(28)-C(29)	1.405(3)
C(1')-C(6')	1.382(3)
C(1')-C(2')	1.385(3)
C(2')-C(3')	1.383(4)
C(3')-C(4')	1.377(4)
C(4')-C(5')	1.378(4)
C(5')-C(6')	1.382(4)
N(1A)-C(2A)	1.306(3)
N(1A)-C(10A)	1.382(3)
C(2A)-O(28A)	1.354(3)
C(2A)-C(3A)	1.422(3)
C(3A)-C(4A)	1.367(3)
C(3A)-C(25A)	1.498(3)
C(4A)-C(5A)	1.432(3)
C(4A)-C(1'A)	1.490(3)
C(5A)-C(6A)	1.411(3)
C(5A)-C(10A)	1.409(3)
C(6A)-C(7A)	1.362(4)
C(7A)-C(8A)	1.392(4)
C(8A)-C(9A)	1.361(4)
C(9A)-C(10A)	1.406(4)
C(11A)-N(12A)	1.472(3)

C(11A)-C(4'A)	1.513(3)
N(12A)-C(13A)	1.368(3)
N(12A)-C(20A)	1.382(3)
C(13A)-N(14A)	1.319(3)
C(13A)-C(23A)	1.485(3)
N(14A)-C(15A)	1.395(3)
C(15A)-C(20A)	1.389(3)
C(15A)-C(16A)	1.393(3)
C(16A)-C(17A)	1.376(4)
C(16A)-C(21A)	1.502(4)
C(17A)-C(18A)	1.389(4)
C(18A)-N(19A)	1.348(3)
C(18A)-C(22A)	1.505(4)
N(19A)-C(20A)	1.331(3)
C(23A)-C(24A)	1.514(4)
C(25A)-O(26A)	1.205(3)
C(25A)-O(27A)	1.310(3)
O(28A)-C(29A)	1.430(3)
C(1'A)-C(6'A)	1.360(3)
C(1'A)-C(2'A)	1.369(3)
C(2'A)-C(3'A)	1.381(4)
C(3'A)-C(4'A)	1.360(3)
C(4'A)-C(5'A)	1.364(3)
C(5'A)-C(6'A)	1.382(4)
CE1-CE2	1.291(8)
CE2-OE1A	1.181(8)
CE2-OE1B	1.224(11)
C(2)-N(1)-C(10)	116.9(2)
N(1)-C(2)-O(28)	121.2(2)
N(1)-C(2)-C(3)	124.9(3)
O(28)-C(2)-C(3)	114.0(2)
C(4)-C(3)-C(2)	119.6(2)
C(4)-C(3)-C(25)	122.7(2)
C(2)-C(3)-C(25)	117.4(2)
C(3)-C(4)-C(5)	117.8(2)
C(3)-C(4)-C(1')	120.1(2)
C(5)-C(4)-C(1')	122.2(2)
C(6)-C(5)-C(10)	119.2(2)
C(6)-C(5)-C(4)	123.3(2)
C(10)-C(5)-C(4)	117.5(2)
C(7)-C(6)-C(5)	120.3(3)
C(6)-C(7)-C(8)	120.1(3)
C(9)-C(8)-C(7)	121.5(3)
C(8)-C(9)-C(10)	120.5(3)
N(1)-C(10)-C(9)	118.2(3)
N(1)-C(10)-C(5)	123.3(2)
C(9)-C(10)-C(5)	118.5(3)
N(12)-C(11)-C(4')	113.96(19)
C(13)-N(12)-C(20)	106.9(2)
C(13)-N(12)-C(11)	128.6(2)
C(20)-N(12)-C(11)	124.4(2)
N(14)-C(13)-N(12)	112.2(2)
N(14)-C(13)-C(23)	125.6(2)
N(12)-C(13)-C(23)	122.2(2)
C(13)-N(14)-C(15)	105.6(2)
C(16)-C(15)-C(20)	118.5(2)
C(16)-C(15)-N(14)	132.2(2)
C(20)-C(15)-N(14)	109.3(2)
C(17)-C(16)-C(15)	114.4(2)
C(17)-C(16)-C(21)	122.1(2)
C(15)-C(16)-C(21)	123.5(2)
C(16)-C(17)-C(18)	122.9(3)

N(19)-C(18)-C(17)	122.7(3)
N(19)-C(18)-C(22)	116.6(3)
C(17)-C(18)-C(22)	120.7(3)
C(20)-N(19)-C(18)	113.3(2)
N(19)-C(20)-N(12)	125.8(2)
N(19)-C(20)-C(15)	128.1(2)
N(12)-C(20)-C(15)	106.0(2)
C(13)-C(23)-C(24)	115.9(2)
O(26)-C(25)-O(27)	126.0(2)
O(26)-C(25)-C(3)	123.2(2)
O(27)-C(25)-C(3)	110.9(2)
C(2)-O(28)-C(29)	118.5(2)
C(6')-C(1')-C(2')	117.4(2)
C(6')-C(1')-C(4)	121.4(2)
C(2')-C(1')-C(4)	121.1(2)
C(3')-C(2')-C(1')	121.1(2)
C(4')-C(3')-C(2')	121.0(2)
C(3')-C(4')-C(5')	118.3(2)
C(3')-C(4')-C(11)	120.4(2)
C(5')-C(4')-C(11)	121.4(2)
C(4')-C(5')-C(6')	120.7(3)
C(1')-C(6')-C(5')	121.5(2)
C(2A)-N(1A)-C(10A)	116.9(2)
N(1A)-C(2A)-O(28A)	120.9(2)
N(1A)-C(2A)-C(3A)	125.2(2)
O(28A)-C(2A)-C(3A)	113.8(2)
C(4A)-C(3A)-C(2A)	118.5(2)
C(4A)-C(3A)-C(25A)	122.8(2)
C(2A)-C(3A)-C(25A)	118.6(2)
C(3A)-C(4A)-C(5A)	118.7(2)
C(3A)-C(4A)-C(1'A)	121.0(2)
C(5A)-C(4A)-C(1'A)	120.3(2)
C(6A)-C(5A)-C(10A)	118.4(2)
C(6A)-C(5A)-C(4A)	123.4(2)
C(10A)-C(5A)-C(4A)	118.2(2)
C(7A)-C(6A)-C(5A)	121.1(3)
C(6A)-C(7A)-C(8A)	120.1(3)
C(9A)-C(8A)-C(7A)	120.4(3)
C(8A)-C(9A)-C(10A)	120.9(3)
N(1A)-C(10A)-C(9A)	118.5(2)
N(1A)-C(10A)-C(5A)	122.5(2)
C(9A)-C(10A)-C(5A)	119.0(2)
N(12A)-C(11A)-C(4'A)	112.05(18)
C(13A)-N(12A)-C(20A)	106.99(18)
C(13A)-N(12A)-C(11A)	126.82(19)
C(20A)-N(12A)-C(11A)	126.13(19)
N(14A)-C(13A)-N(12A)	111.96(19)
N(14A)-C(13A)-C(23A)	126.0(2)
N(12A)-C(13A)-C(23A)	122.0(2)
C(13A)-N(14A)-C(15A)	105.91(18)
C(20A)-C(15A)-C(16A)	118.9(2)
C(20A)-C(15A)-N(14A)	109.06(19)
C(16A)-C(15A)-N(14A)	132.1(2)
C(17A)-C(16A)-C(15A)	114.3(2)
C(17A)-C(16A)-C(21A)	122.8(2)
C(15A)-C(16A)-C(21A)	123.0(2)
C(16A)-C(17A)-C(18A)	123.4(2)
N(19A)-C(18A)-C(17A)	122.7(2)
N(19A)-C(18A)-C(22A)	116.4(2)
C(17A)-C(18A)-C(22A)	120.9(2)
C(20A)-N(19A)-C(18A)	113.5(2)
N(19A)-C(20A)-N(12A)	126.6(2)
N(19A)-C(20A)-C(15A)	127.3(2)

N(12A)-C(20A)-C(15A)	106.07(19)
C(13A)-C(23A)-C(24A)	114.5(2)
O(26A)-C(25A)-O(27A)	124.3(2)
O(26A)-C(25A)-C(3A)	121.3(2)
O(27A)-C(25A)-C(3A)	114.4(2)
C(2A)-O(28A)-C(29A)	118.3(2)
C(6'A)-C(1'A)-C(2'A)	116.9(2)
C(6'A)-C(1'A)-C(4A)	122.4(2)
C(2'A)-C(1'A)-C(4A)	120.7(2)
C(1'A)-C(2'A)-C(3'A)	121.7(2)
C(4'A)-C(3'A)-C(2'A)	121.1(2)
C(3'A)-C(4'A)-C(5'A)	117.4(2)
C(3'A)-C(4'A)-C(11A)	121.2(2)
C(5'A)-C(4'A)-C(11A)	121.3(2)
C(4'A)-C(5'A)-C(6'A)	121.4(2)
C(1'A)-C(6'A)-C(5'A)	121.5(2)
OE(1A)-CE(2)-OE(1B)	86.3(7)
OE(1A)-CE(2)-CE(1)	145.3(13)
OE(1B)-CE(2)-CE(1)	125.4(14)

6n

N(1)-C(2)	1.352(5)
N(1)-N(32)	1.352(5)
N(1)-C(10)	1.396(5)
C(2)-N(30)	1.327(5)
C(2)-C(3)	1.431(6)
C(3)-C(4)	1.356(5)
C(3)-C(25)	1.501(6)
C(4)-C(5)	1.463(5)
C(4)-C(1')	1.485(5)
C(5)-C(10)	1.385(5)
C(5)-C(6)	1.394(6)
C(6)-C(7)	1.379(6)
C(7)-C(8)	1.383(6)
C(8)-C(9)	1.362(6)
C(9)-C(10)	1.384(6)
C(11)-N(12)	1.439(5)
C(11)-C(4')	1.506(5)
N(12)-C(13)	1.372(5)
N(12)-C(20)	1.396(5)
C(13)-N(14)	1.321(5)
C(13)-C(23)	1.489(5)
N(14)-C(15)	1.389(5)
C(15)-C(16)	1.388(5)
C(15)-C(20)	1.388(6)
C(16)-C(17)	1.394(6)
C(16)-C(21)	1.497(6)
C(17)-C(18)	1.387(7)
C(18)-N(19)	1.348(5)
C(18)-C(22)	1.506(6)
N(19)-C(20)	1.334(5)
C(23)-C(24)	1.499(6)
C(25)-O(26A)	1.217(13)
C(25)-O(26B)	1.155(17)
C(25)-O(27A)	1.296(9)
C(25)-O(27B)	1.343(12)
O(27A)-C(28A)	1.4434
C(28A)-C(29A)	1.4526
O(27B)-C(28B)	1.4823
C(28B)-C(29B)	1.4864

N(30)-N(31)	1.354(5)
N(31)-N(32)	1.296(5)
C(1')-C(2')	1.381(5)
C(1')-C(6')	1.385(6)
C(2')-C(3')	1.381(5)
C(3')-C(4')	1.384(5)
C(4')-C(5')	1.379(5)
C(5')-C(6')	1.378(5)
C(2)-N(1)-N(32)	109.2(4)
C(2)-N(1)-C(10)	124.2(4)
N(32)-N(1)-C(10)	126.5(4)
N(30)-C(2)-N(1)	107.9(4)
N(30)-C(2)-C(3)	132.7(4)
N(1)-C(2)-C(3)	119.3(4)
C(4)-C(3)-C(2)	118.8(4)
C(4)-C(3)-C(25)	121.8(4)
C(2)-C(3)-C(25)	119.1(4)
C(3)-C(4)-C(5)	120.4(4)
C(3)-C(4)-C(1')	120.4(4)
C(5)-C(4)-C(1')	119.3(4)
C(10)-C(5)-C(6)	117.3(4)
C(10)-C(5)-C(4)	120.0(4)
C(6)-C(5)-C(4)	122.7(4)
C(5)-C(6)-C(7)	121.2(5)
C(8)-C(7)-C(6)	119.5(5)
C(9)-C(8)-C(7)	120.7(5)
C(10)-C(9)-C(8)	119.3(5)
C(9)-C(10)-C(5)	122.0(4)
C(9)-C(10)-N(1)	121.1(4)
C(5)-C(10)-N(1)	116.9(4)
N(12)-C(11)-C(4')	115.5(4)
C(13)-N(12)-C(20)	105.7(3)
C(13)-N(12)-C(11)	128.9(4)
C(20)-N(12)-C(11)	125.4(4)
N(14)-C(13)-N(12)	114.1(3)
N(14)-C(13)-C(23)	124.4(4)
N(12)-C(13)-C(23)	121.5(4)
C(13)-N(14)-C(15)	103.7(3)
C(16)-C(15)-C(20)	118.1(4)
C(16)-C(15)-N(14)	130.6(4)
C(20)-C(15)-N(14)	111.3(4)
C(15)-C(16)-C(17)	114.6(4)
C(15)-C(16)-C(21)	122.2(4)
C(17)-C(16)-C(21)	123.2(4)
C(18)-C(17)-C(16)	122.7(4)
N(19)-C(18)-C(17)	123.5(4)
N(19)-C(18)-C(22)	116.2(5)
C(17)-C(18)-C(22)	120.4(5)
C(20)-N(19)-C(18)	112.4(4)
N(19)-C(20)-N(12)	126.0(4)
N(19)-C(20)-C(15)	128.8(4)
N(12)-C(20)-C(15)	105.2(4)
C(13)-C(23)-C(24)	113.7(4)
O(26A)-C(25)-O(26B)	24.4(13)
O(26A)-C(25)-O(27A)	124.2(8)
O(26B)-C(25)-O(27A)	110.8(11)
O(26A)-C(25)-O(27B)	119.7(8)
O(26B)-C(25)-O(27B)	126.0(10)
O(27A)-C(25)-O(27B)	41.9(6)
O(26A)-C(25)-C(3)	121.2(7)
O(26B)-C(25)-C(3)	124.9(8)
O(27A)-C(25)-C(3)	113.8(5)

O(27B)-C(25)-C(3)	108.7(6)
C(25)-O(27A)-C(28A)	118.3(6)
O(27A)-C(28A)-C(29A)	109.3
C(25)-O(27B)-C(28B)	117.9(7)
O(27B)-C(28B)-C(29B)	104.3
C(2)-N(30)-N(31)	105.4(4)
N(32)-N(31)-N(30)	112.4(4)
N(31)-N(32)-N(1)	105.1(4)
C(2')-C(1')-C(6')	118.5(4)
C(2')-C(1')-C(4)	120.6(4)
C(6')-C(1')-C(4)	120.9(4)
C(1')-C(2')-C(3')	120.8(4)
C(2')-C(3')-C(4')	120.7(4)
C(5')-C(4')-C(3')	118.2(4)
C(5')-C(4')-C(11)	123.8(4)
C(3')-C(4')-C(11)	118.0(4)
C(4')-C(5')-C(6')	121.3(4)
C(5')-C(6')-C(1')	120.4(4)

6q

C1-C(2)	1.7381(19)
N(1)-C(2)	1.290(2)
N(1)-C(10)	1.371(2)
C(2)-C(3)	1.413(2)
C(3)-C(4)	1.374(2)
C(3)-C(26)	1.497(3)
C(4)-C(5)	1.426(2)
C(4)-C(1')	1.493(2)
C(5)-C(6)	1.412(3)
C(5)-C(10)	1.419(2)
C(6)-C(7)	1.362(3)
C(7)-C(8)	1.402(3)
C(8)-C(9)	1.357(3)
C(9)-C(10)	1.405(3)
C(11)-N(12)	1.458(2)
C(11)-C(4')	1.510(2)
N(12)-C(13)	1.379(2)
N(12)-C(20)	1.383(2)
C(13)-N(14)	1.309(2)
C(13)-C(23)	1.490(3)
N(14)-C(15)	1.387(3)
C(15)-C(20)	1.390(3)
C(15)-C(16)	1.394(3)
C(16)-C(17)	1.389(3)
C(16)-C(21)	1.489(3)
C(17)-C(18)	1.390(3)
C(18)-N(19)	1.348(3)
C(18)-C(22)	1.501(4)
N(19)-C(20)	1.332(3)
C(23)-C(24)	1.500(3)
C(24)-C(25)	1.511(3)
C(26)-O(27)	1.186(2)
C(26)-O(28)	1.314(2)
O(28)-C(29)	1.458(3)
C(29)-C(30)	1.436(4)
C(1')-C(6')	1.377(3)
C(1')-C(2')	1.381(3)
C(2')-C(3')	1.379(3)

C(3')-C(4')	1.385(3)
C(4')-C(5')	1.375(2)
C(5')-C(6')	1.382(3)
C(2)-N(1)-C(10)	116.85(16)
N(1)-C(2)-C(3)	126.27(17)
N(1)-C(2)-C1	116.27(14)
C(3)-C(2)-C1	117.46(15)
C(4)-C(3)-C(2)	117.92(17)
C(4)-C(3)-C(26)	121.59(16)
C(2)-C(3)-C(26)	120.42(16)
C(3)-C(4)-C(5)	118.48(16)
C(3)-C(4)-C(1')	120.46(16)
C(5)-C(4)-C(1')	121.06(15)
C(6)-C(5)-C(10)	118.43(16)
C(6)-C(5)-C(4)	123.59(16)
C(10)-C(5)-C(4)	117.98(16)
C(7)-C(6)-C(5)	120.35(18)
C(6)-C(7)-C(8)	120.7(2)
C(9)-C(8)-C(7)	120.54(19)
C(8)-C(9)-C(10)	120.23(19)
N(1)-C(10)-C(9)	117.85(17)
N(1)-C(10)-C(5)	122.43(16)
C(9)-C(10)-C(5)	119.71(17)
N(12)-C(11)-C(4')	112.30(15)
C(13)-N(12)-C(20)	106.00(15)
C(13)-N(12)-C(11)	128.09(16)
C(20)-N(12)-C(11)	125.28(16)
N(14)-C(13)-N(12)	113.15(17)
N(14)-C(13)-C(23)	124.95(18)
N(12)-C(13)-C(23)	121.89(17)
C(13)-N(14)-C(15)	104.86(16)
N(14)-C(15)-C(20)	110.32(17)
N(14)-C(15)-C(16)	131.0(2)
C(20)-C(15)-C(16)	118.6(2)
C(17)-C(16)-C(15)	114.2(2)
C(17)-C(16)-C(21)	124.3(2)
C(15)-C(16)-C(21)	121.5(2)
C(16)-C(17)-C(18)	123.1(2)
N(19)-C(18)-C(17)	123.0(2)
N(19)-C(18)-C(22)	115.6(2)
C(17)-C(18)-C(22)	121.4(2)
C(20)-N(19)-C(18)	113.1(2)
N(19)-C(20)-N(12)	126.27(18)
N(19)-C(20)-C(15)	128.08(18)
N(12)-C(20)-C(15)	105.65(17)
C(13)-C(23)-C(24)	113.36(18)
C(23)-C(24)-C(25)	112.7(2)
O(27)-C(26)-O(28)	124.51(18)
O(27)-C(26)-C(3)	123.95(18)
O(28)-C(26)-C(3)	111.53(16)
C(26)-O(28)-C(29)	117.02(17)
C(30)-C(29)-O(28)	108.4(2)
C(6')-C(1')-C(2')	118.42(16)
C(6')-C(1')-C(4)	121.31(15)
C(2')-C(1')-C(4)	120.27(16)
C(3')-C(2')-C(1')	120.87(18)
C(2')-C(3')-C(4')	120.78(17)
C(5')-C(4')-C(3')	118.12(16)
C(5')-C(4')-C(11)	121.50(16)
C(3')-C(4')-C(11)	120.38(16)
C(4')-C(5')-C(6')	121.19(17)
C(1')-C(6')-C(5')	120.62(17)

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