Experimental

· General

All air sensitive reactions were carried out under argon in oven-dried glassware using standard syringe and septa techniques, unless otherwise noted. The $^1$H and $^{13}$C NMR were recorded on a Bruker 400 (400 MHz for $^1$H and 100 MHz for $^{13}$C) spectrometer using Chloroform ($^1$H, $\delta = 7.26$) and CDCl$_3$ ($^{13}$C, $\delta = 77.0$) as an internal standards. $^{31}$P NMR were recorded on a Bruker 400 (162 MHz for $^{31}$P) using H$_3$PO$_4$ (85%) as an external standard. Multiplicity and qualifier abbreviations are as follows: s = singlet, d = doublet, t = triplet, q = quartet, quint. = quintet, m = multiplet, br = broad. High resolution mass analyses (HRSM) were recorded using a MicrOTOFQII mass spectrometer. MALDI-TOF mass spectra were measured by using autoflex speed mass spectrometer and the laser at 337 nm by negative mode using 3-hydroxypicolinic acid as the matrix. Thin-layer chromatography was performed on Merck 60 F254 precoated silica gel plates. Merck 60 F254 precoated silica gel on glass in a thickness of 0.9 mm was used for preparative TLC. column chromatography was performed on silica gel (Silica Gel 60 N; 63–210 mesh, KANTO CHEMICAL CO., INC. or 40 – 50 mesh, KANTO CHEMICAL CO., INC.). The ultraviolet-visible (UV-vis) absorption spectra were recorded by a BECKMAN COULTER DU800. ODN synthesis was carried out by the use of an automated DNA synthesizer (ABI, 392 DNA/RNA synthesizer) following the standard phosphoramidite chemistry. High performance liquid chromatography (HPLC) was performed using nacalai tesque cosmosil 5C18MS (4.6 or 10 × 250 mm) as the columns, JASCO PU-986 as the pump, JASCO 2075 as the UV monitoring, and JASCO 2067 as the column oven. pH measurements were measured performed on Mettler Toledo Seven Easy pH meter using ORION 8220BNWP as the electrode. Densitometric analysis of the gel was carried out on the 20% denaturing polyacrylamide gel plates, and visualized, quantified with use of a FLA-5100 Fluor Imager. Commercial available reagents were obtained from Wako Pure Chemical Industries Ltd., KANTO CHEMICAL CO., INC. and used without further purification. DNA and RNA oligomer was purchased from Japan Bio Services Co., LTD. (Saitama, JAPAN), buffers and salts from Nacalai tesque.
**Fig S1** HPLC analysis for the stability confirmation of ON1 and ON2. 10 μM of ON1 or ON2 was incubated in 100 mM NaCl, 50 mM MES, pH 7 at 37 °C and analyzed by HPLC at indicated time.
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Fig S3 Crosslink reaction of ON 3 with DNA 1. a) The summary for the time course of the crosslink yield, Y = A; Y = G; Y = C; Y = U. b) HPLC analysis of the crosslink reaction between ON 3 (▲: diastereomers) and DNA 1 (●, N = C). ● referred as cross-link adduct. The aliquot of the reaction mixture was collected at each indicated time and injected to HPLC. The analysis was performed with reverse-phase HPLC with C-18 column (nacalai tesque: COSMOSIL SC18-MS-II, 4 × 250 mm) by a linear gradient of 10-40%/20 min of acetonitrile in 0.1 M TEAA buffer at a flow rate of 1 ml/min and monitored by UV absorbance at λ = 255 nm. c) MALDI-spectrum of isolated crosslink adduct.
Fig S4 Oxidation of ON 2 by H$_2$O$_2$ and FeCl$_2$. a) HPLC analysis for the oxidation reaction of ON 2 (▲). ● referred as oxidized product ON 3. The aliquot of the reaction mixture was collected and injected to HPLC at indicated time. b) MALDI-TOF spectroscopy of the reaction mixture for the oxidation of ON 2. The mixture was treated with Zip-tip treatment thereafter MALDI-TOF mass spectroscopy was measured. All reactions were performed with 10 μM ON 2 in the presence of 100 μM of FeCl$_2$ and 200 μM of H$_2$O$_2$. 
It is thought that ferryl ion is generated from Fe\textsuperscript{2+} in two pathways.\textsuperscript{1} The first route to ferryl ion is by the reaction of perferryl ion which is an intermediate product produced through Fe\textsuperscript{2+}-O\textsubscript{2} or Fe\textsuperscript{3+}-O\textsubscript{2}\textsuperscript{-}, with another Fe\textsuperscript{2+} (Scheme S1a). The second route relies on H\textsubscript{2}O\textsubscript{2} to generate ferryl ion (Scheme S1b). It is reported that Fenton reagents (Fe\textsuperscript{2+} and H\textsubscript{2}O\textsubscript{2}) produce ferryl ion rather than ·OH (Scheme S1c) under proper conditions such as pH and buffer.\textsuperscript{2} The condition employed in the crosslink reaction might be preferred for the formation of ferryl ion than ·OH, because sodium formate did not influence the crosslink reaction. Thus, high-level generation of ferryl ion in the presence of H\textsubscript{2}O\textsubscript{2} explains that higher crosslink yield was observed when H\textsubscript{2}O\textsubscript{2}.
and FeCl₂ are used as an oxidant than FeCl₂ alone. Furthermore, it is suspected that potassium iodide and sodium ascorbate prohibit the generation of ferryl ion by quenching \(^3\)O₂ and high oxidation potential iron species respectively, and that O₂⁻ generated form Fe²⁺ (Scheme S1a) would be relatively low therefore the influence of SOD for the crosslink reaction was small. Nevertheless, how sodium azide inhibit the oxidation reaction of ON 2 is indecisive.


**Synthesis of 9-[(4-(tert-Butyl-dimethyl-silyloxy)-5-(tert-butyl-dimethyl-silyloxy)methyl)-3-methoxy-tetrahydro-furan-2-yl]-6-(1,2-dibromo-ethyl)-9H-purin-2-ylamine**

To a solution of 3 (216 mg, 0.403 mmol) in CHCl₃ (12 ml), was dropwised 2% bromine water (6.4 ml) using dropping funnel at 0 °C. After stirred 6 h at 0 °C, 0.5 M Na₂S₂O₃ aq. was added to the reaction mixture. The mixture was extracted with CHCl₃. The organic phase was dried over anhydrous Na₂SO₄, filtered, and concentrated in vacuo. The residue was purified by silica gel column chromatography (Hexane-AcOEt, 15:1 to 5:1) to afford described product (180 mg, 64%, 1:1 mixture of diastereomer) as a pale orange foam.

\(^1\)H NMR (400 MHz, CDCl₃ for 1:1 mixture of diastereomer) δ 0.086 (s, 6H), 0.089 (s, 6H), 0.12 (s, 6H), 0.14 (s, 6H), 0.92 (s, 18 H), 0.93 (s, 18 H), 3.46 (s, 3H), 3.47 (s, 3H), 3.77 (dd, \(J = 4.2, 11.6\) Hz, 1H), 3.92 (dd, \(J = 2.0, 11.6\) Hz, 1H), 3.93 (dd, \(J = 2.0, 11.6\) Hz, 1H), 4.00 (dd, \(J = 3.2, 4.8\) Hz, 1H), 4.03 (dd, \(J = 3.2, 4.8\) Hz, 1H), 4.08 (ddd, \(J = 2.0, 2.0, 4.2\) Hz, 1H), 4.13 (dd, \(J = 4.8, 4.8\) Hz, 1H), 4.14 (dd, \(J = 4.8, 4.8\) Hz, 1H), 4.52 (dd, \(J = 2.0\) Hz, \(J = 4.8\) Hz, 1H), 4.53 (dd, \(J = 2.0, 4.8\) Hz, 1H), 4.59 (dd, \(J = 9.6, 11.2\) Hz, 1H), 4.63 (dd, \(J = 9.6, 11.2\) Hz, 1H), 5.25 (brs, 2H), 5.26 (brs, 2H), 5.66 (dd, \(J = 4.8, 11.2\) Hz, 1H), 5.69 (dd, \(J = 4.8, 11.2\) Hz, 1H), 6.05 (d, \(J = 4.8\) Hz, 1H), 8.08 (s, 1H), 8.10 (s, 1H); \(^1\)C NMR (100 MHz, CDCl₃) δ -5.4, -5.3, -4.7, -4.6, 18.2, 18.5, 25.8, 26.0, 43.3, 43.5, 58.5, 62.0, 62.1, 69.9, 70.0, 83.5, 83.6, 85.2, 85.9, 86.0, 126.0, 126.1, 140.8, 153.8, 153.9, 156.3, 156.3, 159.8, 159.58; HRMS-ESI (m/z): [M+H]⁺ calcd for C₂₅H₄₅N₅O₄Si₂Br₂, 694.1450; found, 694.1441.
· Synthesis of 6-(1,2-Bis-ethylsulfanyl-ethyl)-9-[4-(tert-butyl-dimethyl-silylenoxy)-5-(tert-butyl-dimethyl-silyloxyethyl)-3-methoxy-tetrahydro-furan-2-yl]-9H-purin-2-ylamine (4)

To a solution of 4 (78 mg, 0.112 mmol) in CH₂Cl₂ (0.10 M), was added DBU (42 μL, 0.280 mmol) at 0 °C. After stirred 1 hour at 0 °C, EtSH was added to the reaction mixture and stirred for additional s hours. The reaction mixture was directly applied to silica gel column chromatography (CHCl₃-AcOEt, 1:0 to 10:1) to afford 5 (41.7 mg, 57%) as a pale yellow foam.

¹H NMR (400 MHz, CDCl₃, for 1:1 mixture of diastereomer) δ 0.065 (s, 6H), 0.078 (s, 6H), 0.12 (s, 6H), 0.13 (s, 6H), 0.90 (s, 9 H), 0.93 (s, 9 H), 1.18-1.23 (m, 6H), 2.50-2.65 (m, 4H), 3.16 (dd, J = 4.8, 12.8 Hz, 1H), 3.45 (s, 3H), 3.45 (s, 3H), 3.46-3.52 (m, 1H), 3.75 (dd, J = 2.8, 11.2 Hz, 1H), 3.76 (dd, J = 2.8, 11.2 Hz, 1H), 3.92 (dd, J = 3.6, 11.2 Hz, 1H), 4.05-4.08 (m, 1H), 4.16 (dd, J = 4.8, 4.8 Hz, 1H), 4.17 (dd, J = 4.8, 4.8 Hz, 1H), 4.52 (dd, J = 4.8, 4.8 Hz, 1H), 4.58 (dd, J = 4.8, 4.8 Hz, 1H), 4.61 (dd, J = 4.8, 4.8 Hz, 1H), 5.11 (brs, 2H), 5.12 (brs, 2H), 6.01 (d, J = 4.8, 1H), 6.02 (d, J = 4.8, 1H), 7.97 (s, 1H); ¹³C NMR (100 MHz, CDCl₃) δ -5.5, -5.4, -5.3, -4.7, -4.6, 14.6, 14.7, 14.8, 18.2, 18.4, 18.5, 25.8, 25.9, 26.0, 26.0, 26.3, 26.4, 34.3, 34.4, 44.7, 44.9, 58.4, 62.1, 70.0, 76.7, 77.1, 77.4, 83.2, 83.3, 85.0, 85.0, 86.0, 126.8, 126.7, 139.9, 140.0, 152.9, 153.0, 159.7, 159.7, 161.3, 161.4; HRMS-ESI (m/z): [M+H]+ calcd for C₂₃H₃₆N₅O₃S₅Si₂: 658.3307; found, 658.3315.

· Synthesis of N-6-(1,2-Bis-ethylsulfanyl-ethyl)-9-[4-(tert-butyl-dimethyl-silylenoxy)-5-(tert-butyl-dimethyl-silyloxyethyl)-3-methoxy-tetrahydro-furan-2-yl]-9H-purin-2-yl]-2-phenoxy-acetamide

To a solution of 5 (203 mg, 0.310 mmol) in pyridine (0.10 M), was added PacCl (106 μL, 0.774 mmol) at 0 °C. After stirred 1 hour at 0 °C, the reaction mixture was allowed to warm up to room temperature. After stirred 23 h at room temperature, the reaction mixture was diluted with CH₂Cl₂ and washed with sat. NaHCO₃ and brine. The organic phase was dried over anhydrous Na₂SO₄, filtered, and concentrated in

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vacuo The residue was purified with silica gel column chromatography (Hexane-AcOEt, 10:1 to 4:1) to afford 6 (234 mg, 96%) as a pale yellow foam.

$^1$H NMR (400 MHz, CDCl$_3$ for 1:1 mixture of diastereomer) $\delta$ 0.097 (s, 6H), 0.10 (s, 6H), 0.11 (s, 6H), 0.12 (s, 6H), 0.92 (s, 9 H), 1.19-1.25 (m, 6H), 2.51-2.70 (m, 4H), 3.12 (dd, $J = 4.2, 13.6$ Hz, 1H), 3.56 (s, 3H), 3.58 (s, 3H), 3.52-3.59 (m, 1H), 3.78 (dd, $J = 2.8, 11.2$ Hz, 1H), 4.04 (dd, $J = 3.6, 11.2$ Hz, 1H), 4.10-4.11 (m, 1H), 4.35-4.38 (m, 1H), 4.51 (dd, $J = 4.2, 4.2$ Hz, 1H), 4.52 (dd, $J = 4.4, 4.4$ Hz, 1H), 4.68 (dd, $J = 1.6, 4.2$ Hz, 1H), 4.71 (dd, $J = 1.6, 4.2$ Hz, 1H), 4.77 (brs, 2H), 6.13 (d, $J = 3.6$, 1H), 6.15 (d, $J = 3.6$, 1H), 7.02 (d, $J = 8.4$, 3H), 7.32 (dd, $J = 8.4$, 8.4, 2H), 7.33 (d, $J = 8.4$, 8.4, 2H), 8.31 (s, 1H), 8.92 (brs, 1H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ -5.39, -5.37, -5.31, -4.74, -4.60, 14.6, 14.6, 18.2, 18.5, 18.5, 25.8, 26.0, 26.1, 26.4, 34.2, 34.3, 44.6, 44.7, 58.5, 61.8, 68.0, 69.6, 82.3, 85.1, 86.9, 87.1, 115.0, 122.3, 129.8, 143.1, 143.1, 151.7, 151.7, 151.7, 161.6, 161.2; HRMS-ESI (m/z): [M+H]$^+$ calcld for C$_{37}$H$_{65}$N$_5$O$_9$S$_2$I$_2$, 792.3675; found, 792.3629.

- Synthesis of N-[6-(1,2-Bis-ethylsulfanyl-ethyl)-9-(4-hydroxy-5-hydroxymethyl-3-methoxy-tetrahydro-furan-2-yl)-9H-purin-2-yl]-2-phenoxo-acetamide (5)

To a solution of 6 (234 mg, 0.295 mmol) in THF (0.10 M), was added TBAF (1 M THF solution, 890 µL, 0.886 mmol) at room temperature. After stirred 90 minutes at room temperature, the reaction mixture was diluted with EtOAc and washed with H$_2$O and brine. The organic phase was dried over anhydrous Na$_2$SO$_4$, filtered, and concentrated in vacuo The residue was purified with silica gel column chromatography (CHCl$_3$-MeOH, 1:0 to 25:1) to afford 7 (171 mg, quant.) as a pale yellow foam.

$^1$H NMR (400 MHz, CDCl$_3$ for 1:1 mixture of diastereomer) $\delta$ 1.17-1.23 (m, 6H), 2.50-2.67 (m, 4H), 3.19 (dd, $J = 4.8, 13.6$ Hz, 1H), 3.20 (dd, $J = 4.8, 13.6$ Hz, 1H), 3.41 (s, 3H), 3.51 (d, $J = 13.6$ Hz, 1H), 3.54 (d, $J = 13.6$ Hz, 1H), 3.82 (d, $J = 12.8$ Hz, 1H), 3.99 (d, $J = 12.8$ Hz, 1H), 4.25 (brs, 1H), 4.26 (brs, 1H), 4.64-4.72 (m, 5H), 5.96 (brs, 1H), 5.97 (brs, 1H), 7.00-7.04 (m, 3H), 7.33 (d, $J = 8.4$, 8.4, 2H), 8.14 (s, 1H), 8.15 (s, 1H), 9.22 (brs, 1H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 14.4, 14.4, 14.5, 14.5, 25.9, 26.1, 26.2, 33.9, 34.0, 44.4, 44.5, 58.6, 62.3, 67.6, 69.6, 77.2, 85.2, 86.8, 88.3, 88.4, 114.8, 122.2, 129.7, 144.3, 151.2, 151.2, 151.2, 151.3, 156.8, 162.3, 166.5; HRMS-ESI (m/z): [M+H]$^+$ calcld for C$_{35}$H$_{63}$N$_5$O$_9$S$_2$, 564.1945; found, 564.1876.
· Synthesis of N-(6-(1,2-Bis-ethylsulfanyl-ethyl)-9-[5-[bis-(4-methoxy-phenyl)-phenyl-methoxy methyl]-4-hydroxy-3-methoxy-tetrahydro-furan-2-yl]-9H-purin-2-yl)-2-phenoxy-acetamide

To a solution of 7 (71.4 mg, 0.127 mmol) in pyridine (0.10 M), was added DMTrCl (88.2 μL, 0.260 mmol) at 0 °C. After stirred 90 minutes at 0 °C, the reaction mixture was diluted with CH₂Cl₂ and washed with sat. NaHCO₃ and brine. The organic phase was dried over anhydrous Na₂SO₄, filtered, and concentrated in vacuo. The residue was purified with silica gel column chromatography (Hexane-AcOEt, 2:1 to 1:2) to afford 8 (93.3 mg, 85%) as a pale yellow foam.

¹H NMR (400 MHz, CDCl₃, for 1:1 mixture of diastereomer) δ 1.20-1.27 (m, 6H), 2.52-2.71 (m, 4H), 3.51 (d, J = 6.4 Hz, 1H), 3.24 (dd, J = 5.2, 13.2 Hz, 1H), 3.25 (dd, J = 5.2, 13.2 Hz, 1H), 3.45-3.61 (m, 3H), 3.68 (s, 3H), 3.70 (s, 3H), 4.18-4.21 (m, 1H), 4.45-4.46 (m, 1H), 4.56-4.72 (m, 4H), 6.18 (d, J = 3.2, 1H), 6.19 (d, J = 3.6, 1H), 6.80 (d, J = 8.8, 4H), 7.01-7.06 (m, 3H), 7.19-7.24 (m, 4H), 7.32-7.36 (m, 5H), 7.42-7.43 (m, 2H), 8.20 (s, 1H), 8.24 (s, 1H), 8.93 (brs, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 14.5, 14.5, 14.6, 26.0, 26.1, 26.2, 26.2, 34.1, 44.6, 55.1, 58.9, 62.8, 63.0, 67.9, 69.4, 69.5, 77.2, 82.9, 83.0, 83.7, 86.4, 86.7, 113.1, 114.8, 122.2, 126.8, 127.8, 128.1, 130.0, 135.5, 135.7, 142.4, 142.5, 144.5, 151.5, 151.6, 157.1, 158.4, 158.4, 161.8; HRMS-ESI (m/z): [M+H]⁺ calcd for C₉₀H₇₆N₁₄O₁₃S₂, 866.3252; found, 866.3185.

· Synthesis of Diisopropyl-phosphoramidous acid 5-[6-(1,2-bis-ethylsulfanyl-ethyl)-2-(2-phenoxy-acetylamino)-purin- 9-yl]-2-[bis-(4-methoxy-phenyl)-phenyl-methoxymethyl]-4-methoxy-tetrahydro -furan-3-yl ester 2-cyano- ethyl ester (6)

To a solution of 8 (93.3 mg, 0.107 mmol) and DIPEA (110 μL, 0.646 mmol) in CH₂Cl₂ (0.05 M), was added phosphitylation reagent (88.2 μL, 0.260 mmol) at 0 °C. After stirred 70 minutes at 0 °C, the reaction mixture was diluted with CH₂Cl₂ and washed with sat. NaHCO₃ and brine. The organic phase was dried over anhydrous Na₂SO₄, filtered, and concentrated in vacuo. The residue was purified with silica gel
column chromatography (Hexane-AcOEt, 2:1 to 1:1 + 1% Et₃N) to afford 9 (89.8 mg, 79%) as a pale yellow foam.

$^{31}$P NMR (162 MHz, CDCl₃ for four diastereomers) δ 150.4, 150.9, 151.0,

**· Synthesis, Cleavage and purification of oligonucleotide**

All ONs were synthesized at a 1 μmol scale on ABI 392 DNA/RNA synthesizer with standard β-cyanoethyl phosphoramidite chemistry. 5‘-terminal dimethoxytrityl bearing ONs were removed from the solid support by treatment with 28% NH₃ (0.5 ml) and evaporated under reduced pressure. The crude product was purified by reverse-phase HPLC with C-18 column (nacalai tesque: COSMOSIL 5C18-MS-II, 10 × 250 mm) by a linear gradient of 10-40%/20 min of acetonitrile in 0.1 M TEAA buffer at a flow rate of 4 ml/min. Dimethoxytrityl group of the purified ON was removed with 10% AcOH and the mixture was additionally purified by ethanol precipitation to afford ON 1; MALDI-TOF MS ($m/z$): [M-H] calcul 4422.1; found 4421.0.

![HPLC profile of crude product](image1)

![HPLC profile of ON 1 after purification](image2)

![MALDI-TOF MS spectrum of crude product](image3)
· **Synthesis of thiovinyl oligo (ON 2)**

To a solution of ON 1 (30 μL, 5.0 nmol), was added NaOH (4 M, 10 μL). After incubation for 14 h at room temperature, AcOH (25 μL) was added to the reaction mixture to neutralize. Subsequently, the reaction mixture was purified by HPLC to afford ON 2 (thiovinyl); MALDI-TOF MS (m/z): [M-H] calcd 4359.0; found 4359.6.

· **Synthesis of sulfinylvinyl oligo (ON 3)**

To a solution of ON 2 (26.8 μL, 3.0 nmol), was added a solution of magnesium monoper-phthalate (MMPP) (3 μl, 15 nmol) in carbonate buffer adjusted to pH 10 at room temperature. After 30 minutes at room temperature, the thiovinyl was completely converted to sulfinyl vinyl that was confirmed by MALDI TOF-MS and HPLC analysis. The product was not enough stable to isolate, therefore that was used for each assay without purification; MALDI-TOF MS (m/z): [M-H] calcd 4375.0; found 4378.5.

· **General procedure of the crosslink reaction**

The reaction was performed with 10 μM of ON 2, 3 or 5 and 5 μM of the target DNA or RNA labeled by fluorescein at 5’-end in a buffer of 100 mM or 500 mM NaCl and 50 mM MES at pH 7.0. The reaction mixture was incubated at 37 °C. The aliquot of the reaction mixture was reaction was collected at each indicated time and quenched with the addition of loading dye (95% formamide, 20 mM EDTA, 0.05% xylene cyanol, and 0.05% bromophenol blue). The cross-linked products were analyzed by a denaturing 20% polyacrylamide gel electrophoresis containing urea (7 M) with TBE buffer at 300 V for 1 h. The labeled bands were visualized and quantified with use of a FLA-5100 Fluor Imager.

· **Crosslink reaction with H₂O₂ and metal ion**

To the duplex solution of ON 2 and RNA 1 in a buffer of MES containing NaCl and H₂O₂, was added an aqueous solution of metal ion as to be the indicated final concentration. The reaction mixture was incubated at 37 °C for 1 hour and analyzed in the same manner described above.

· **Crosslink reaction with H₂O₂ and FeCl₂ in the presence of scavenger**

The scavenger was added to the duplex solution of ON 2 and RNA 1 in a buffer of MES containing NaCl before the addition of H₂O₂ and FeCl₂. After the addition of the H₂O₂ and FeCl₂, the reaction mixture was incubated at 37 °C for 1 hour and analyzed in the same manner described above.
9-[4-(tert-Butyl-dimethyl-silanyloxy)-5-(tert-butyl-dimethyl-silanyloxymethyl)-3-methoxy-tetrahydro-furan-2-yl]-6-(1,2-dibromo-ethyl)-9H-purin-2-ylamine

$^1$H NMR: (400 MHz, CDCl$_3$)

$^{13}$C NMR: (100 MHz, CDCl$_3$)
6-(1,2-Bis-ethylsulfanyl-ethyl)-9-[4-(tert-butyl-dimethyl-silanyloxy)-5-(tert-butyl-dimethyl-silanyloxymethyl)-3-methoxy-tetrahydro-furan-2-yl]-9H-purin-2-ylamine (4)

\(^1^H\) NMR: (400 MHz, CDCl\(_3\))

\(^1^C\) NMR: (100 MHz, CDCl\(_3\))
N-{6-(1,2-Bis-ethylsulfanyl-ethyl)-9-[4-(tert-butyl-dimethyl-silyloxy)-5-(tert-butyl-dimethyl-silyloxy methyl)-3-methoxy-tetrahydro-furan-2-yl]-9H-purin-2-yl}-2-phenoxy-acetamide

$^1$H NMR: (400 MHz, CDCl$_3$)

$^{13}$C NMR: (100 MHz, CDCl$_3$)
N-[6-(1,2-Bis-ethylsulfanyl-ethyl)-9-(4-hydroxy-5-hydroxymethyl-3-methoxy-tetrahydro-furan-2-yl)-9H-purin-2-yl]-2-phenoxy-acetamide (5)

$^1$H NMR: (400 MHz, CDCl$_3$)

$^{13}$C NMR: (100 MHz, CDCl$_3$)
$N$-(6-(1,2-Bis-ethylsulfanyl-ethyl))-9-{5-[bis-(4-methoxy-phenyl)-phenyl-methoxymethyl]-4-hydroxy-3-methoxy-tetrahydro-furan-2-yl)-9H-purin-2-yl)-2-phenoxy-acetamide

$^1$H NMR: (400 MHz, CDCl$_3$)

$^1$C NMR: (100 MHz, CDCl$_3$)
Diisopropyl-phosphoramidous acid 5-[6-(1,2-bis-ethylsulfanyl-ethyl)-2-(2-phenoxy-acetylamino)-purin-9-yl]-2-[bis-(4-methoxy-phenyl)-phenyl-methoxymethyl]-4-methoxy-tetrahydro-furan-3-yl ester 2-cyano-ethyl ester (6)

$^1$H NMR: (400 MHz, CDCl$_3$)

$^{31}$P NMR: (162 MHz, CDCl$_3$)