The chirality of the sugar-backbone units in natural nucleic acids is responsible for the formation of the high-order structure of the nucleic acids and for their functions as well. Organisms on the earth utilize only the D-sugar. Nevertheless, calculations and other studies suggest that modified nucleic acids based on L-sugar recognize complementary nucleic acids. Furthermore, oligonucleotides composed of 2-deoxy-L-ribose (2-deoxy-L-erythrose) show resistance to digestion by certain nucleases. Enantiomeric DNA (DNA having 2-deoxy-L-ribose) and meso-DNA (DNA having an alternating sequence of L-sugar and D-sugar) are, therefore, valuable tools for studying protein-DNA interactions and are promising antisense agents. In this regard, there still remains a need for the efficient synthetic method for 2-deoxy-L-ribose. Among a few known methods for the synthesis of 1-4, only the glycal method developed by Deriaz et al. has been used in practice. Herein we report a new efficient method for the synthesis of compound 1 starting from L-ascorbic acid (2).

L-Ascorbic acid (2) was converted to 5,6-O-isopropylidene derivative 3 in 95% yield by treatment with acetyl chloride in acetonitrile. Oxidation of 3 with hydrogen peroxide in the presence of calcium carbonate afforded the threonic acid derivative 4 in 72% yield. Compound 4 was transformed into the methyl ester 5 in 95% yield with methyl iodide and sodium bicarbonate in dimethylacetamide. The secondary hydroxyl group of 5 was tosylated with tosyl chloride and triethylamine in methylene chloride to give compound 6 in 90% yield. The reduction of tosylate 6 with sodium borohydride in methanol and subsequent epoxidation of the resulting 1,2-hydroxysaccharide with potassium carbonate were carried out in one pot to afford epoxide 7 in 63% yield. Reaction of compound 7 with lithiated 1,3-dithiane in THF at -40 °C provided white solid 8 in 70% yield. To a solution of thioacetal 8 (0.18 g, 0.68 mmol) in water (16 mL)-acetone (16 mL) was added 1.0 N HCl (1.0 mL) at room temperature. After stirring for 30 min, HgO (0.66 g, 3.04 mmol) and HgCl2 (0.80 g, 2.96 mmol) were added to the reaction mixture and the stirring continued for further 2 h at 40°C. The reaction mixture was filtered and acetone was removed in vacuo. To the remaining aqueous solution was added Na2S (0.86 g, 3.56 mmol) and precipitated HgS was removed. The volume of aqueous solution was reduced to a half by freeze-drying. Isopropyl alcohol (20 mL) was added to the aqueous solution and precipitated sodium chloride was removed by filtration. The filtrate was evaporated to give a pale yellow syrup which was crystallized in vacuum after one week. Recrystallization of the
crude crystal from ethyl acetate gave pure 2-deoxy-L-ribose (1.06 g. 70%). The overall yield of the present procedure is 18%. The present method is superior over Deriaz's glycal method* at least in two aspects: the overall yield and the cost of the starting material.

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14. Compound 4: mp. 56–58°C; 1H NMR (80 MHz, CDCl₃) δ 1.22 (s, 6H), 2.37 (s, 3H), 3.63 (s, 3H), 3.88–3.92 (m, 2H), 4.28–4.48 (m, 1H), 4.75–4.81 (d, 1H), 7.19–7.98 (2d, 4H).
16. Compound 8: mp. 71°C; 1H NMR (300 MHz, CDCl₃) δ 1.17 (s, 3H), 1.35~2.10 (m, 4H), 2.21 (s, 1H), 2.76~2.84 (m, 5H), 3.85~4.03 (m, 3H), 4.19~4.24 (m, 1H).
17. Compound 1: mp. 89°C (lit. 90°C); [α]D +55.0° (c = 0.27, H₂O) (lit. +58°); 1H NMR (200 MHz, D₂O) δ 1.64~2.50 (m, 2H), 3.57~4.42 (m, 4H), 5.30~5.66 (m, 1H).