# Synthesis of 2-Deoxy-2-fluoro-D-glucose

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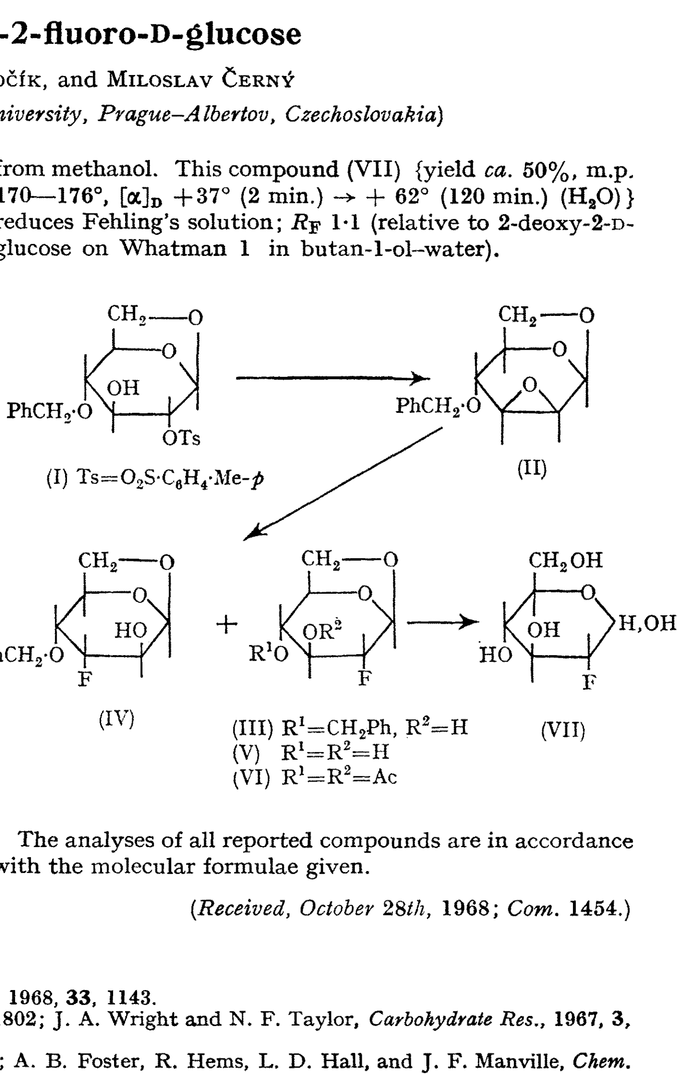
FLUORINATED CARBOHYDRATES have been much investigated.[1] During studies on 1,6-anhydro-β-D-glucopyranose, we have prepared 2-deoxy-2-fluoro-D-glucose (VII).

The starting compound (II)[2] [m.p. 63—65°, $[\alpha]_D$ −34° ($CHCl_3$)] was prepared by the action of sodium methoxide on the corresponding toluene-*p*-sulphonate[3] (I). With potassium hydrogen fluoride (boiling ethylene glycol,[4] 2 hr., under $CO_2$), (I) gave (after chromatographic separation on silica gel) a fluorohydrin (III) as the main product, together with a small amount of the isomeric compound (IV). The fluorohydrin (III), m.p. 67—70°, $[\alpha]_D$ −43° ($CHCl_3$), is thought to have the *gluco*-configuration, and its isomer (IV), m.p. 102—103°, $[\alpha]_D$ −95° ($CHCl_3$), the *altro*-configuration. The proposed structures of both compounds are in accordance[5] with their n.m.r. spectra (100 MHz; $CDCl_3$): acetate of (III), $\tau$ 4·43 (complex, H-1), 5·74 (d,H-2, $J_{F\text{-}2,H\text{-}2}$ 45 Hz), 4·86 (d, H-3, $J_{F\text{-}2,H\text{-}3}$ 17 Hz), and 6·73 (complex, H-4); acetate of (IV), 4·47 (q, H-1, $J_{H\text{-}1,H\text{-}2}$ 1·5, $J_{F\text{-}3,H\text{-}1}$ 6·5 Hz), 4·77 (octet, H-2, $J_{F\text{-}3,H\text{-}2}$ 13, $J_{H\text{-}1,H\text{-}2}$ 1·5, $J_{H\text{-}2,H\text{-}3}$ 8·5 Hz), 5·20 (octet, H-3, $J_{H\text{-}2,H\text{-}3}$ 8·5, $J_{F\text{-}3,H\text{-}3}$ 48, $J_{H\text{-}3,H\text{-}4}$ 4·5 Hz), and 6·04 (m, H-4)].

Hydrogenolysis of (III) (Pd–C, EtOH, 40—50°) gave a compound (V), m.p. 129—130°, $[\alpha]_D$ −72°($H_2O$) [diacetate (VI), m.p. 60—61°, $[\alpha]_D$ −67·5 ($CHCl_3$), n.m.r. (100 MHz; $CDCl_3$) $\tau$ 4·43 (complex, H-1), 5·74 (d, H-2, $J_{F\text{-}2,H\text{-}2}$ 45 Hz), 5·0 (d, H-3, $J_{F\text{-}2,H\text{-}3}$ 17 Hz), and 5·34 (complex, H-4)].

2-Deoxy-2-fluoro-D-glucose (VII) was prepared by hydrolysis of (V) in a sealed tube at 165° with aqueous (1%) toluene-*p*-sulphonic acid (5 hr.). After deacidification (Amberlite IR 45) a syrup was isolated which crystallised from methanol. This compound (VII) {yield *ca.* 50%, m.p. 170—176°, $[\alpha]_D$ +37° (2 min.) → + 62° (120 min.) ($H_2O$)} reduces Fehling's solution; $R_F$ 1·1 (relative to 2-deoxy-2-D-glucose on Whatman 1 in butan-1-ol–water).



(I) $Ts{=}O_2S{\cdot}C_6H_4{\cdot}Me\text{-}p$

(II)

(IV)

(III) $R^1{=}CH_2Ph$, $R^2{=}H$
(V) $R^1{=}R^2{=}H$
(VI) $R^1{=}R^2{=}Ac$

(VII)

The analyses of all reported compounds are in accordance with the molecular formulae given.

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