# CRYSTAL STRUCTURES OF LARGE-VOLUME COMMERCIAL PHARMACEUTICALS

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As part of a continuing project, the challenging room-temperature crystal structures of five commercial pharmaceutical APIs have been solved by Monte Carlo simulated annealing techniques using synchrotron X-ray powder diffraction data (11-BM at APS), and optimized using density functional techniques. **Atorvastatin calcium trihydrate (Lipitor®)**, $(C_{33}H_{34}FN_2O_5)_2Ca(H_2O)_3$ crystallizes in space group *P1* (#1) with $a$ = 5.44731(4), $b$ = 9.88858(16), $c$ = 29.5925(10) Å, $\alpha$ = 95.859(3), $\beta$ = 94.211(1), $\gamma$ = 105.2790(1)°, $V$ = 1521.277(10) Å$^3$, and $Z$ = 1. The structure was solved by removing the O atoms from the carboxylate groups of the anion, and using a $CaO_6$ fragment. **Pimecrolimus (Elidel)**, $C_{43}H_{68}ClNO_{11}$, crystallizes in space group $P2_1$ (#4) with $a$ = 15.28864(7), $b$ = 13.31111(4), $c$ = 10.95529(5) Å, $\beta$ = 96.1542(3)°, $V$ = 2216.649(9) Å$^3$, and $Z$ = 2. By default, simulated annealing programs did not give enough torsional degrees of freedom, so the macrocycle was broken, and re-formed at a low success rate. **Ivermectin hemihydrate ethanolate**, $(C_{48}H_{74}O_{14})(H_2O)_{0.5}(C_2H_5OH)_{0.68}$, crystallizes in space group *I2* (#5) with $a$ = 14.94878(15), $b$ = 9.26938(4), $c$ = 39.27263(30) Å, $\beta$ = 94.4017(7)°, $V$ = 5425.80(5) Å$^3$, and $Z$ = 4. A reduced cell search yielded another solvate, and the guest species were identified using difference Fourier and spectroscopic techniques. **Ceftriaxone sodium hemiheptahydrate (Rocefin)**, $C_{18}H_{16}N_8O_7S_3Na_2(H_2O)_{3.5}$, crystalizes in space group *C2* (#5) with $a$ = 30.56495(19), $b$ = 4.75245(3), $c$ = 18.55021(18) Å, $\beta$ = 90.3551(7)°, $V$ = 2694.521(24) Å$^3$, and $Z$ = 4. Some of the water molecules were difficult to locate conventionally, and were placed by progressively searching for smaller voids. **Valganciclovir hydrochloride (Valcyte®)**, $C_{14}H_{23}N_6O_5Cl$, crystallizes in space group $P2_12_12_1$ (#19), with $a$ = 7.07915(22), $b$ = 11.34560(29), $c$ = 49.3012(20) Å, $V$ = 3959.74(21) Å$^3$, and $Z$ = 8. Solution and refinement were made difficult by the limited data range, the relatively large size of the structure, the broad peaks, low crystallinity, and significant preferred orientation. Other new structures may be discussed as they become available.