(A) Integration of conditions \log MMD \downarrow Var. explained by condition ↓ Wasserstein J 0.10 * Holdout 0.05 0.00 -0.10 * Training 0.05 LEMUR -Harmony -PCA 🕂 LEMUR -0.00 CPA-PCA-Rigid LEMUR Param. Harmony Rigid LEMUR LEMUR-PCA-Param. Harmony -Rigid LEMUR PCA LEMUR-CPA scVI Param. Harmony CPA scVI Harmony Param. Harmony Rigid LEMUR CPA Harmony Harmony (B) Biological signal retention k-NN Overlap ↑ 20 15 10 5 0.0 0 0.0 0.0 20 15 Training 10 0.5 5 0 0.0 scVI-CPA-Harmony scVI-Harmony -LEMUR-PCA-LEMUR-PCA LEMUR CPA PCA PCA LEMUR scVI CPA Rigid LEMUR Rigid LEMUR Rigid LEMUR CPA Param. Harmony Rigid LEMUR scVI Harmony Param. Harmony Param. Harmony Harmony Param. Harmony (C) Ratio of variance explained $\frac{condition}{cell\ type}$ (log-scale) 10^{-1} 10^{-3} 10^{-5} 10^{-1} 10^{-3} 10^{-5} LEMUR-PCAscVI-Harmony Param. Harmony Rigid LEMUR CPA