(A) Integration of conditions log MMD ↓ Wasserstein J Var. explained by condition \downarrow 0.10 Holdout 0.05 0.00 --5.5 0.10 * Training 0.05 LEMUR -Harmony 🔓 😋 PCA 🕂 LEMUR -0.00 CPA-PCA-Rigid LEMUR scVI -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 0.5 5 0 0.0 scVI-Harmony scVI-CPA LEMUR-PCA LEMUR CPA LEMUR. PCA LEMUR scVI CPA Rigid LEMUR PCA Harmony 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