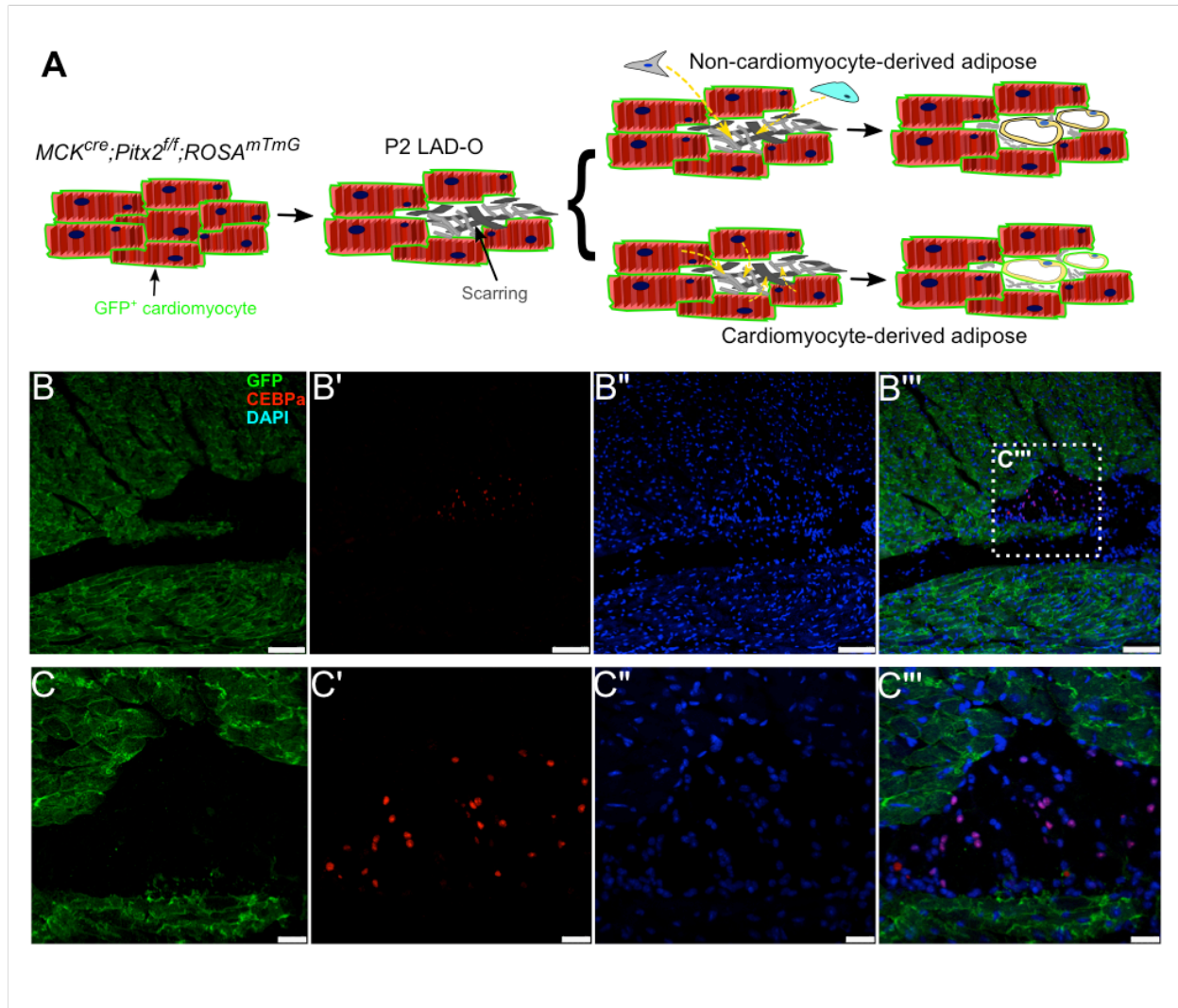
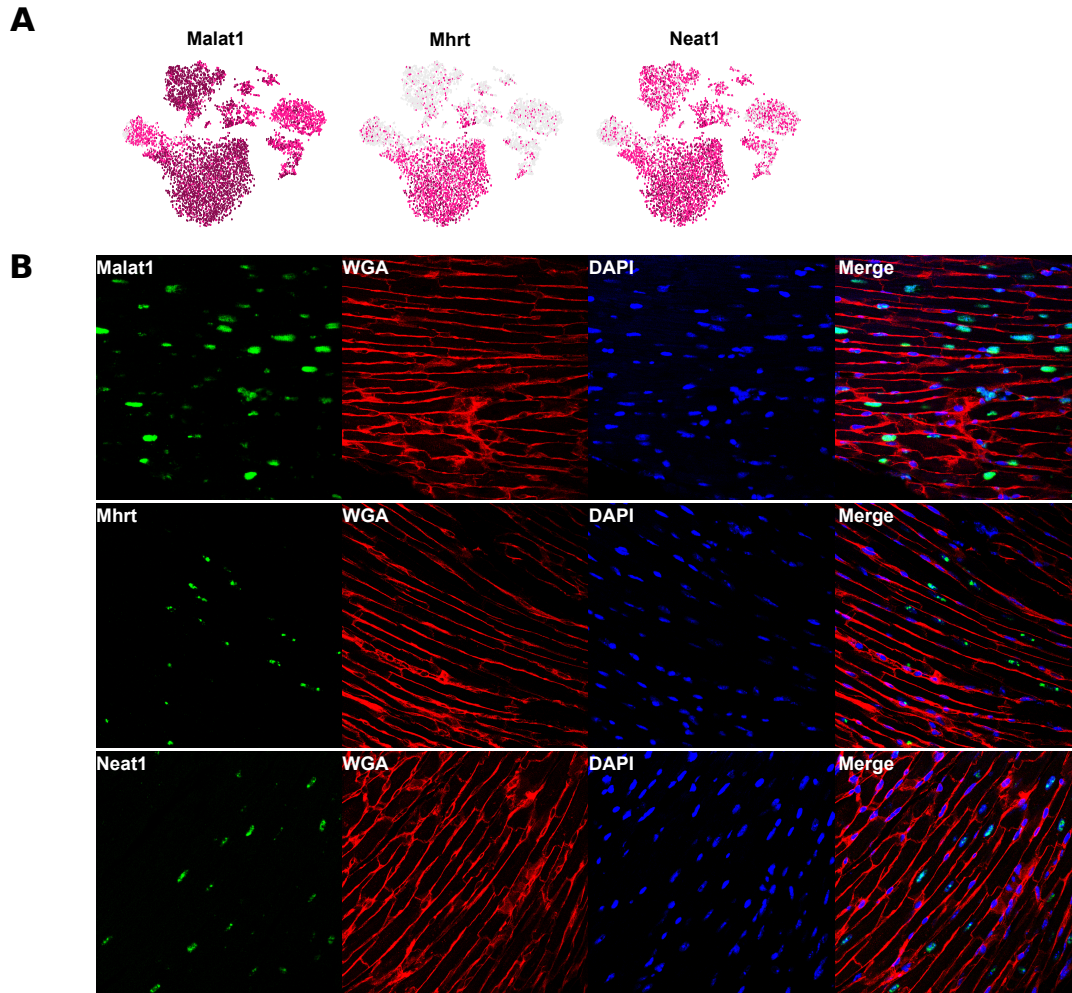


**Figure S1. Trichrome staining of hearts collected at 21 DPMI after LAD occlusion at day 2. (A, A', B, B') *Pitx2* CKO hearts showed small area of adipose-like tissue. Quantitative result was shown in Figure 1E.**



**Fig. S2. Lineage tracing shows a non-cardiomyocyte origin of the adipose-like tissue.** (A) A *mT/mG* ROSA reporter is crossed to both control (*MCK<sup>cre</sup>*) and *Pitx2* CKO strains. LAD occlusion was performed on postnatal day 2, and hearts were collected at 60 days after the occlusion. (B-B''', C-C''') Immunostaining was performed to detect C/EBP $\alpha$  (red), and DAPI (blue) in *Pitx2* CKO hearts; endogenous GFP was also observed.



**Fig. S3. lncRNA expression and heterogeneity of single cardiomyocyte nuclei.** (A) Feature plot of gene expression across cardiac snRNA-seq tSNE. Low expression is gray, and high expression is pink. (B) Fluorescent RNA in situ hybridization for *Malat1*, *Mhrt*, and *Neat1* in adult non-mutant cardiac tissue sections.