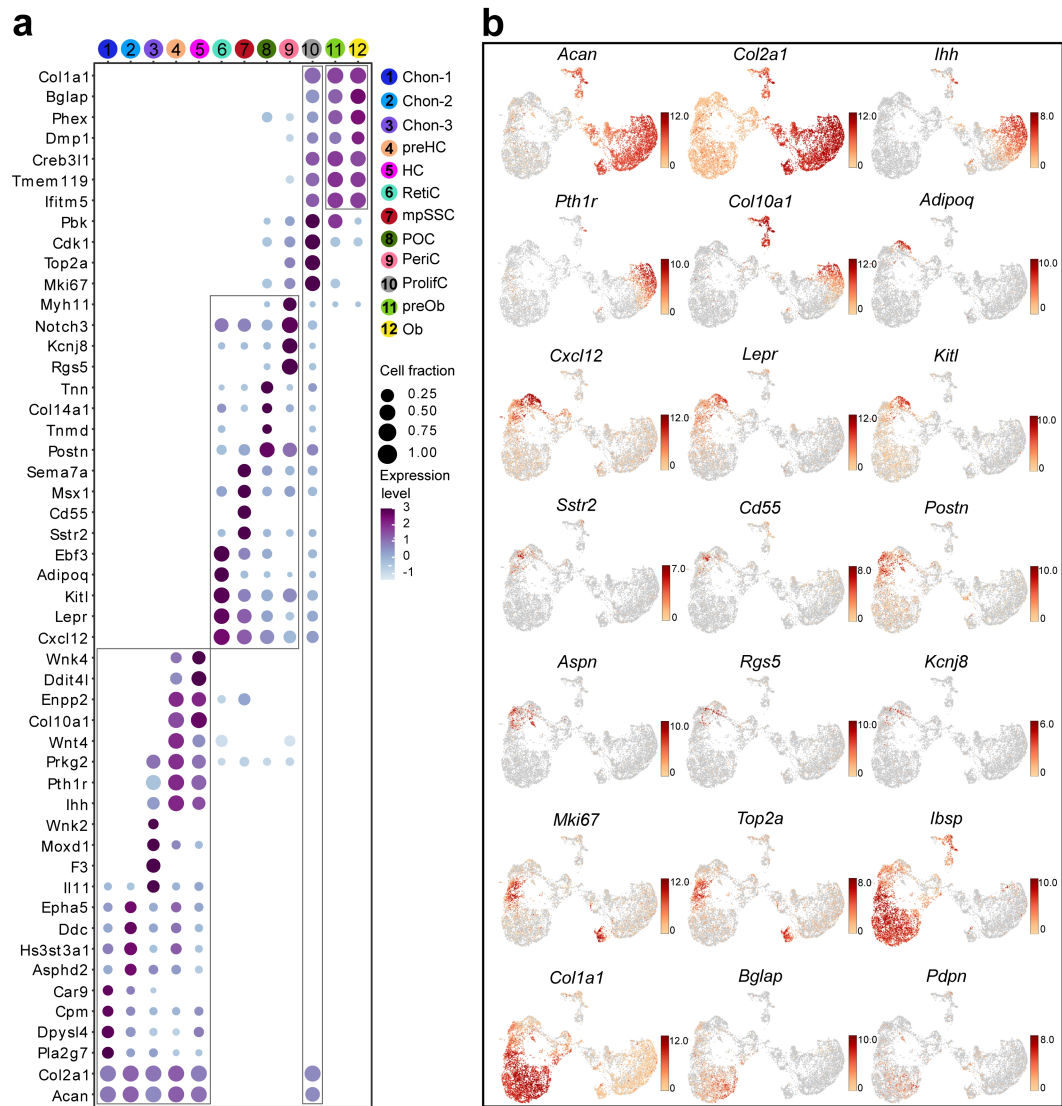
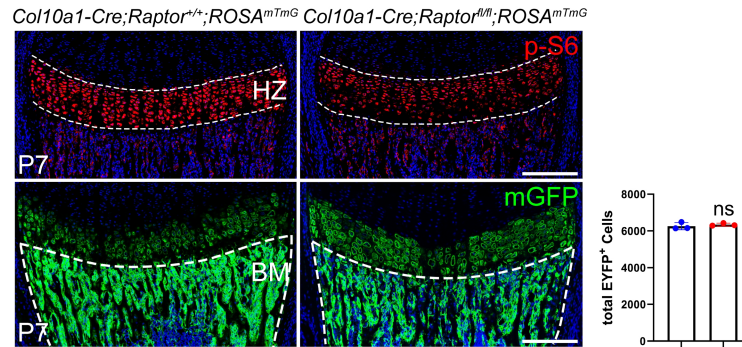




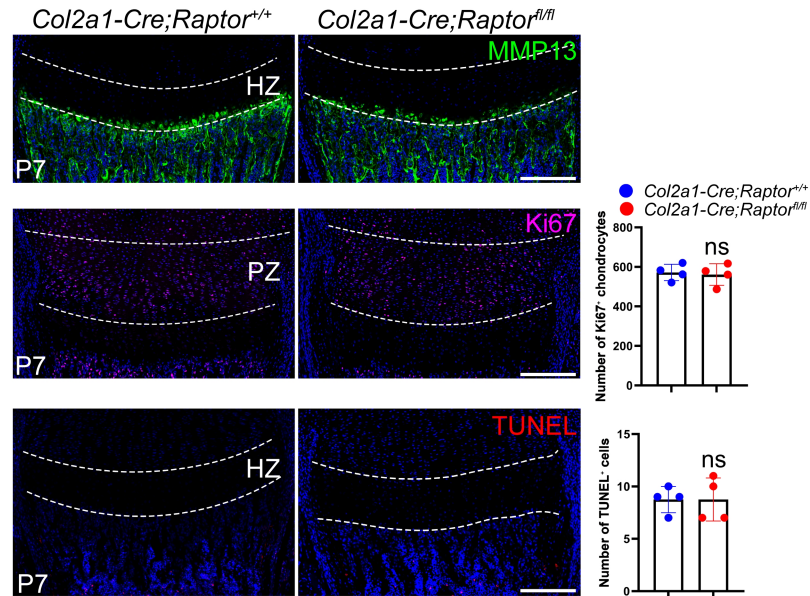
Supplementary Fig. 1. Expression of representative marker genes for cell-type annotation.

(a) Dot plot showing the expression of representative marker genes across the 12 annotated cell populations. Dot size represents the fraction of cells expressing each gene, and color intensity indicates the expression level. Grey frames indicate genes enriched in chondrocyte clusters, mesenchymal clusters, proliferating clusters, and OLC clusters, respectively. **(b)** UMAP feature plots showing the expression of representative genes used to identify major cell populations, including chon-1/-2/-3 (*Acan*, *Col2a1*), preHC (*Ihh*, *Pth1r*), HC (*Col10a1*), RetiC (*Cxcl12*, *Lepr*, *Kitl*, *Adipoq*), mpSSC (*Sstr2*, *Cd55*), periosteal cell (*Postn*, *Aspn*), pericyte (*Rgs5*, *Kcnj8*), proliferating cell (*Mki67*, *Top2a*), and osteogenic cell (*Ibsp*, *Col1a1*, *Bglap*, *Pdpn*). Color intensity reflects relative expression levels. Chon-1, Chon-2, and Chon-3: Chondrocyte; preHC: pre-hypertrophic chondrocyte; HC: hypertrophic chondrocyte; RetiC: reticular stromal cell; mpSSC: metaphyseal skeletal stem cell; POC: periosteal cell; PeriC: pericyte; prolifC: proliferating cell; preOb: pre-osteoblast; Ob: osteoblast.



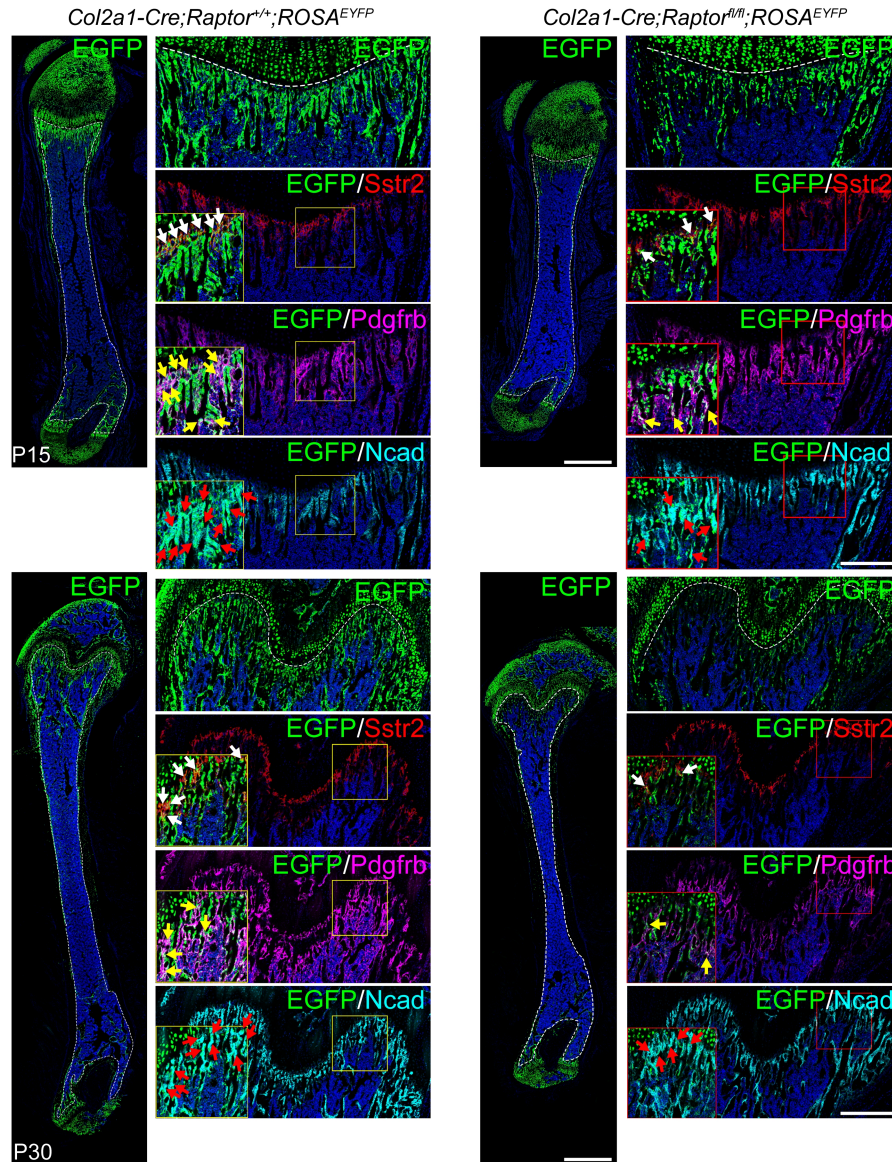
Supplementary Fig. 2. *Col10a1-Cre*-mediated *Raptor* deletion in HCs does not affect the HC progeny number.

Representative immunofluorescence staining for p-S6 in distal femoral growth plates from *Col10a1-Cre;Raptor*^{+/+};ROSA^{mTmG} and *Col10a1-Cre;Raptor*^{fl/fl};ROSA^{mTmG} mice at P7. The mGFP-labeled HC descendants in the metaphysis were comparable between *Col10a1-Cre;Raptor*^{+/+};ROSA^{mTmG} and *Col10a1-Cre;Raptor*^{fl/fl};ROSA^{mTmG} mice. Hypertrophic zone is outlined by dashed lines. Data are presented as mean $\pm$ SEM. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, **** $p < 0.0001$; ns, not significant. Scale bars, 250 μ m. Each dot represents one mouse; n = 3 mice per group.

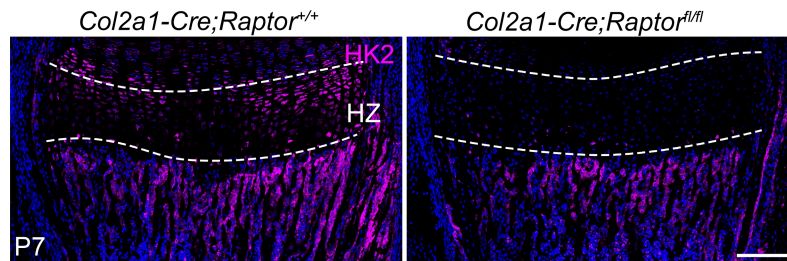


Supplementary Fig. 3. mTORC1 inactivation by *Col2a1-Cre*-mediated *Raptor* deletion does not affect the chondrocytes proliferation, HCs differentiation, and apoptosis.

Representative immunofluorescence staining for MMP13 and Ki67, together with TUNEL staining in distal femoral growth plates from *Col2a1-Cre;Raptor*^{+/+} and *Col2a1-Cre;Raptor*^{fl/fl} mice at P7). Quantification of Ki67-positive chondrocytes in the proliferative zone (PZ) and TUNEL-positive cells immediately below the hypertrophic zone. HZ is outlined by dashed lines. ns, not significant. Scale bars, 250 μ m. Each dot represents one mouse; n = 4 mice per group.



Supplementary Fig. 4. Representative immunofluorescence staining of EYFP, Sstr2, Pdgfrb, and N-cadherin in *Col2a1-Cre;Raptor^{+/+};ROSA^{EYFP}* and *Col2a1-Cre;Raptor^{fl/fl};ROSA^{EYFP}* femur at P15 and P30, related to Figure 3a. Scale bars, 500 μ m (overview) and 250 μ m (magnified).



Supplementary Fig. 5. *Raptor* deletion leads to the reduction expression of hexokinase 2.

Representative immunofluorescence images of hexokinase 2 (HK2) expression in femoral growth plates at P7. HZ is outlined by dashed lines. Scale bars, 250 μm .