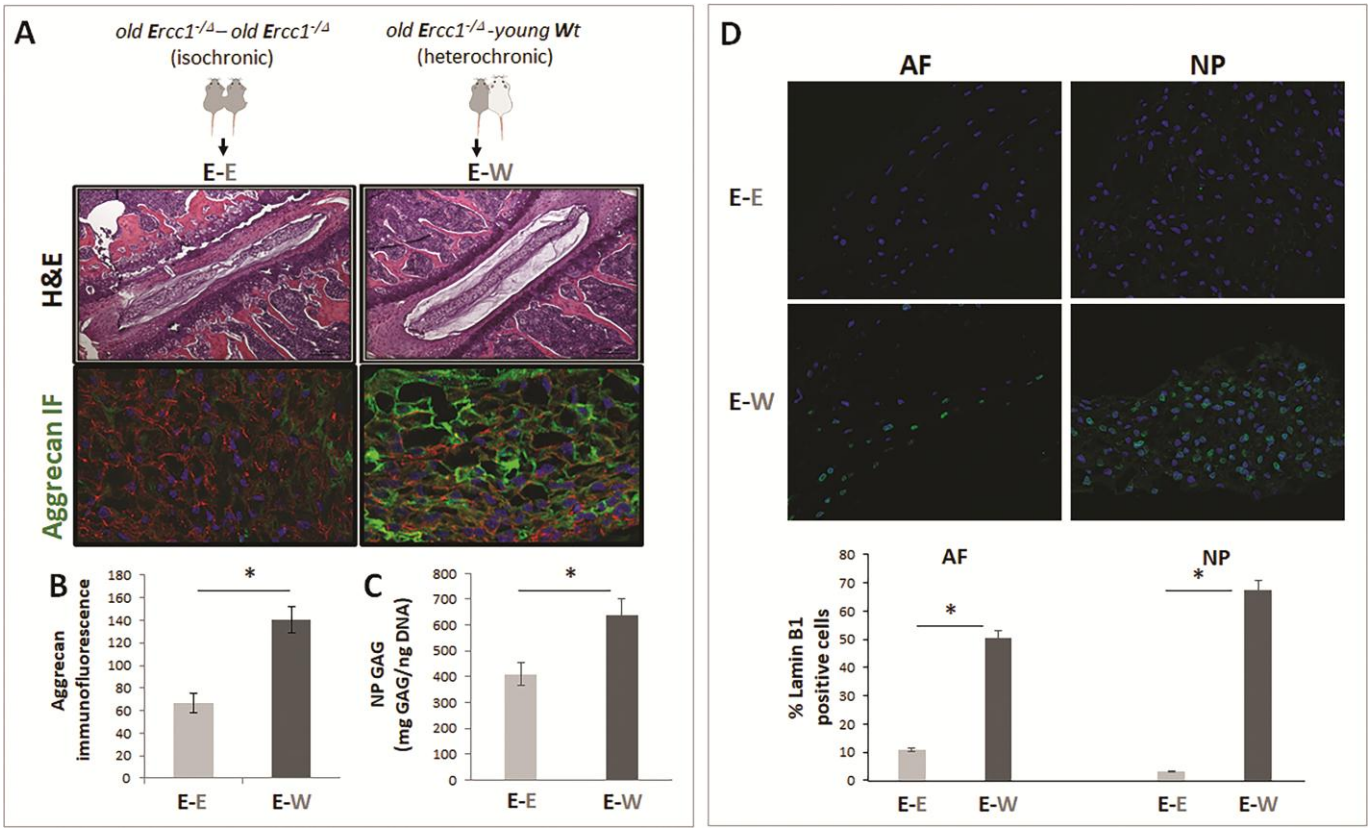
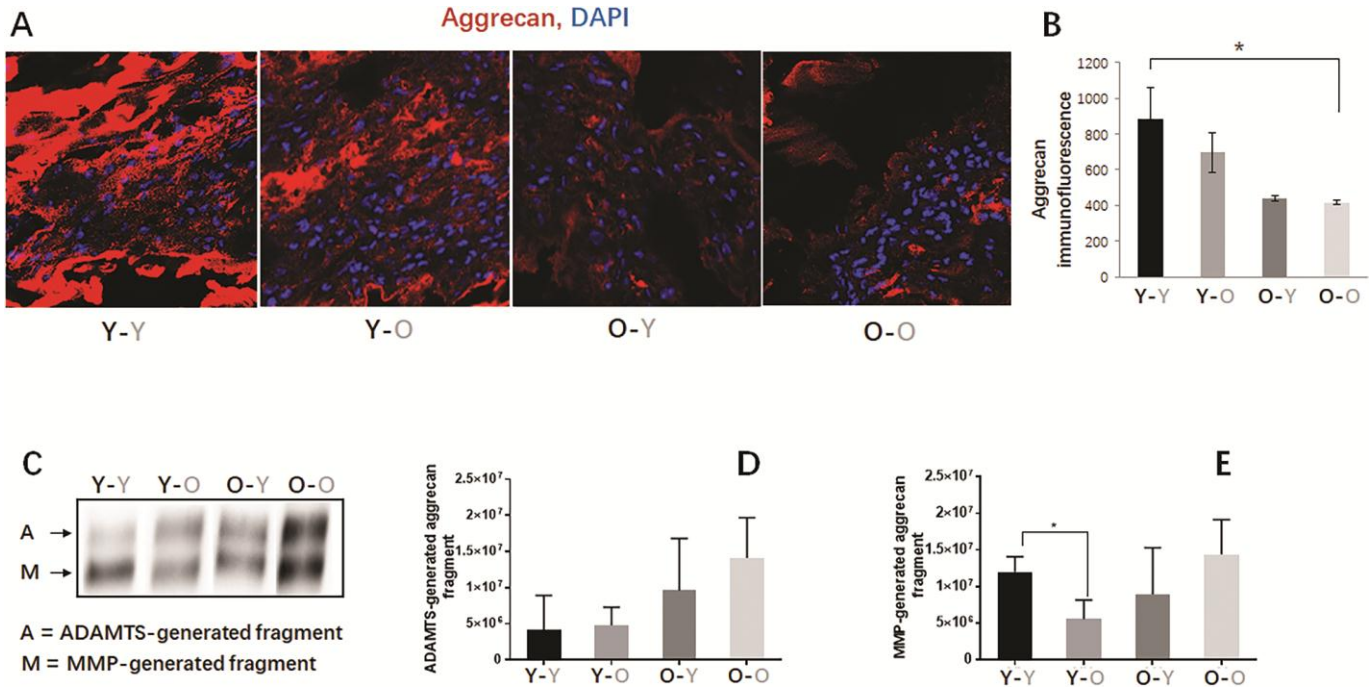
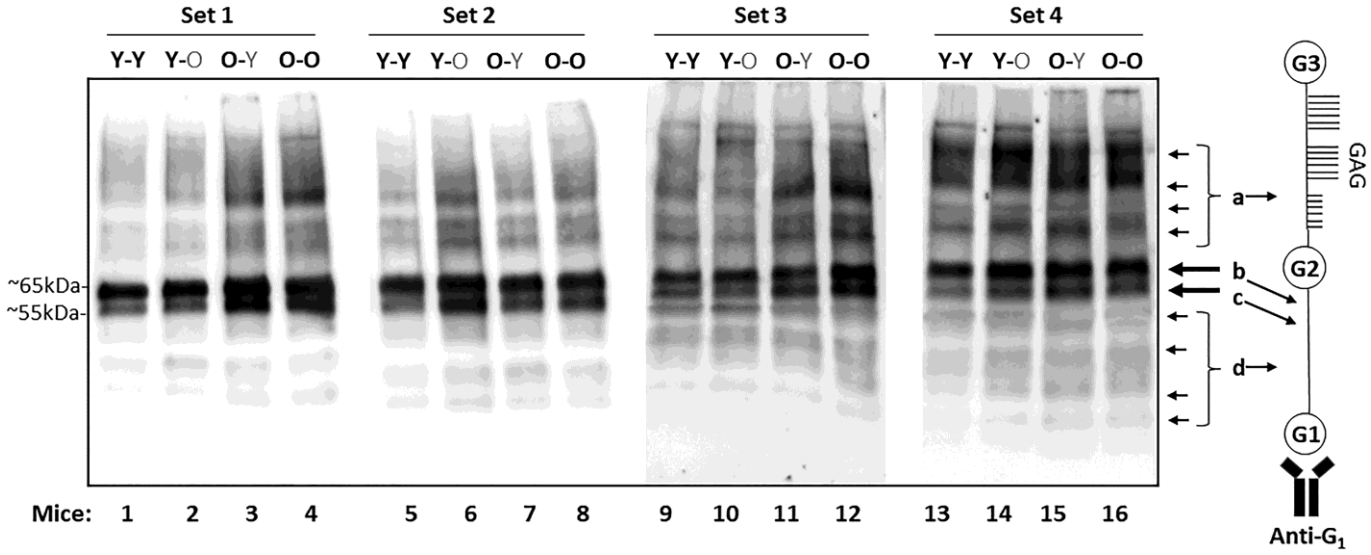
## SUPPLEMENTARY FIGURES



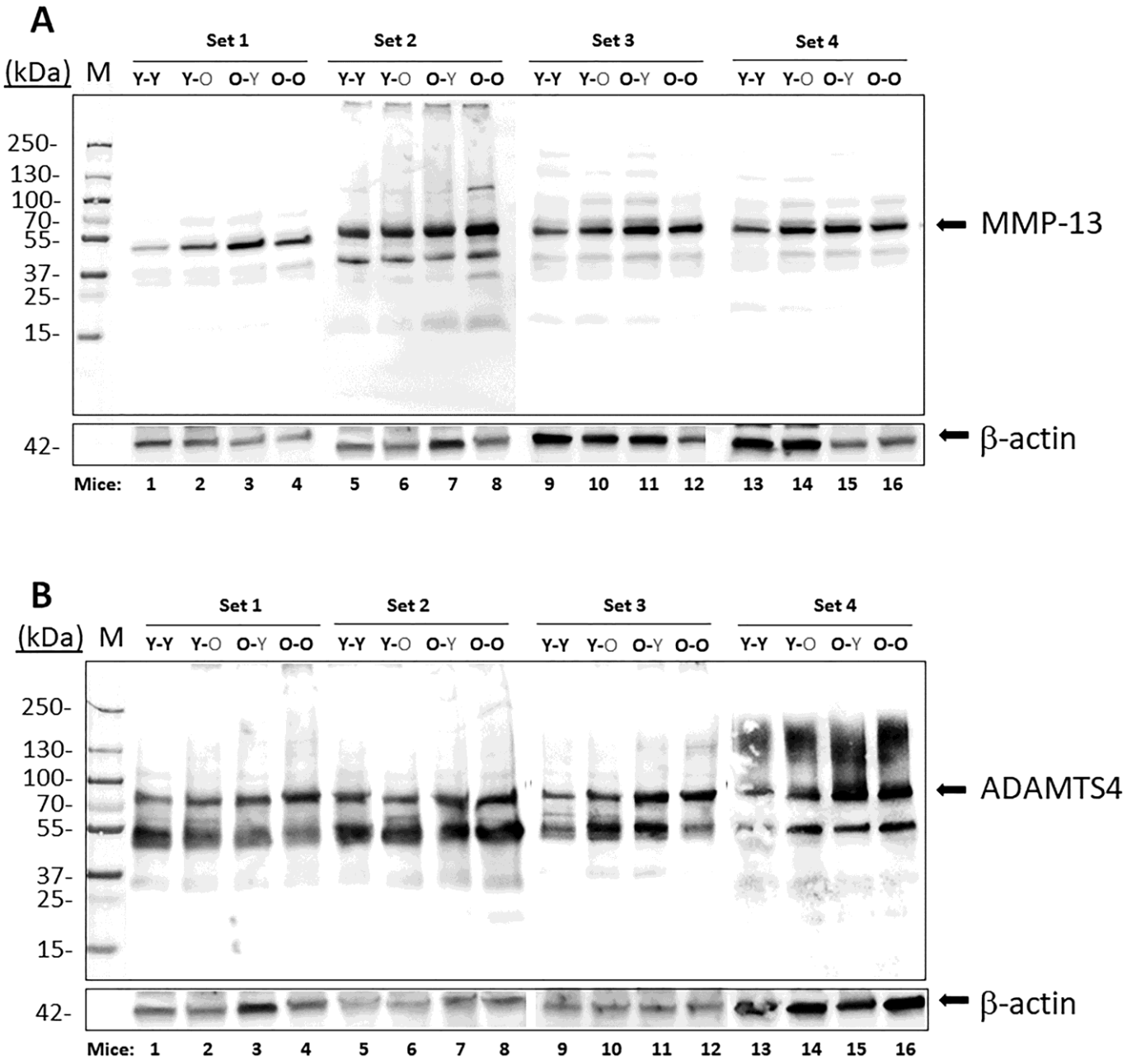

**Supplementary Figure 1. Effects of young circulatory factors on disc matrix PG homeostasis in accelerating *Ercc1*$^{-/\Delta}$ mice.** (**A**) Discs of *Ercc1*$^{-/\Delta}$ mice from heterochronic parabiosis showed improved histologic features and increased NP aggrecan immunofluorescence compared to those measured in *Ercc1*$^{-/\Delta}$ mice from an isochronic model. Discs of *Ercc1*$^{-/\Delta}$ mice from heterochronic parabiosis showed increased NP aggrecan immunofluorescence (**B**) and GAG content (**C**) compared to those in *Ercc1*$^{-/\Delta}$ mice from an isochronic model. (**D**) Quantitative immunofluorescence of a cellular senescence marker, lamin B, in AF and NP tissues of isochronic and heterochronic *Ercc1*$^{-/\Delta}$ mice. Data shown are mean ± *SD* of 3-5 independent experiments, *$p < 0.05$.



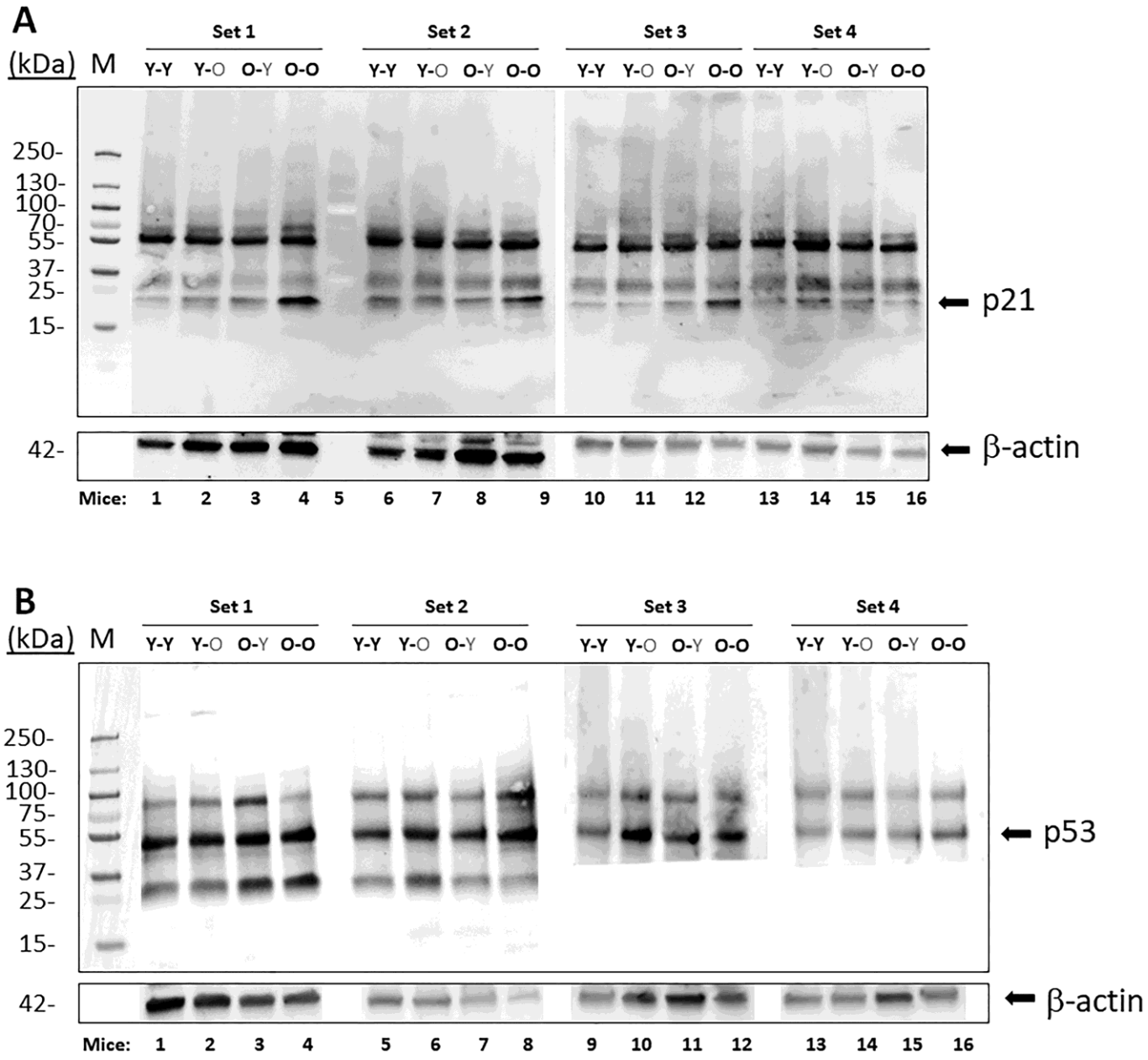

**Supplementary Figure 2. Influences of circulatory factors on matrix homeostasis in the intervertebral discs of mice heterochronically-paired for one month.** (**A**) Representative images showing the effects of circulatory factors on aggrecan immunofluorescence in the nucleus pulposus of mouse parabionts. (**B**) Quantification of the NP aggrecan immunofluorescence. shown in the bar graph. Data shown are mean ± *SEM* of four independent experiments (n=4 per group), *$p < 0.05$. (**C**) representative immunoblots of MMP- and ADAMTS-mediated cleavage of disc aggrecan of the four different mouse parabionts. Graphs on right are quantification of ADAMTS-generated aggrecan fragment (**D**) and MMP-generated aggrecan fragment (**E**). Data shown are mean ± *SD* of four independent experiments, *$p < 0.05$.




**Supplementary Figure 3. Full Western Blots from Figure 2 are shown here.** Anti-G1 detected multiple aggrecan fragments derived from cleavage sites between G2 and G3 globular domains (**a**) and between G1 and G2 globular domains (**b**, **c**, **d**). For the sake of clarity, we chose to show only the major proteolytic aggrecan fragments derived from the cleavage sites between G1 and G2 interglobular domains by ADAMTS (**b**) and MMP (**c**) proteases in Figure 2 because these fragments resulted in loss of the entire GAG region from the aggrecan aggregate in disc tissue and are commonly considered most pathological.




**Supplementary Figure 4.** Full Western Blots for MMP13 (**A**) and ADAMTS4 (**B**) from which Figure 3 were derived.




**Supplementary Figure 5.** Full Western Blots for p21 (**A**) and p53 (**B**) from which Figure 4 were derived.