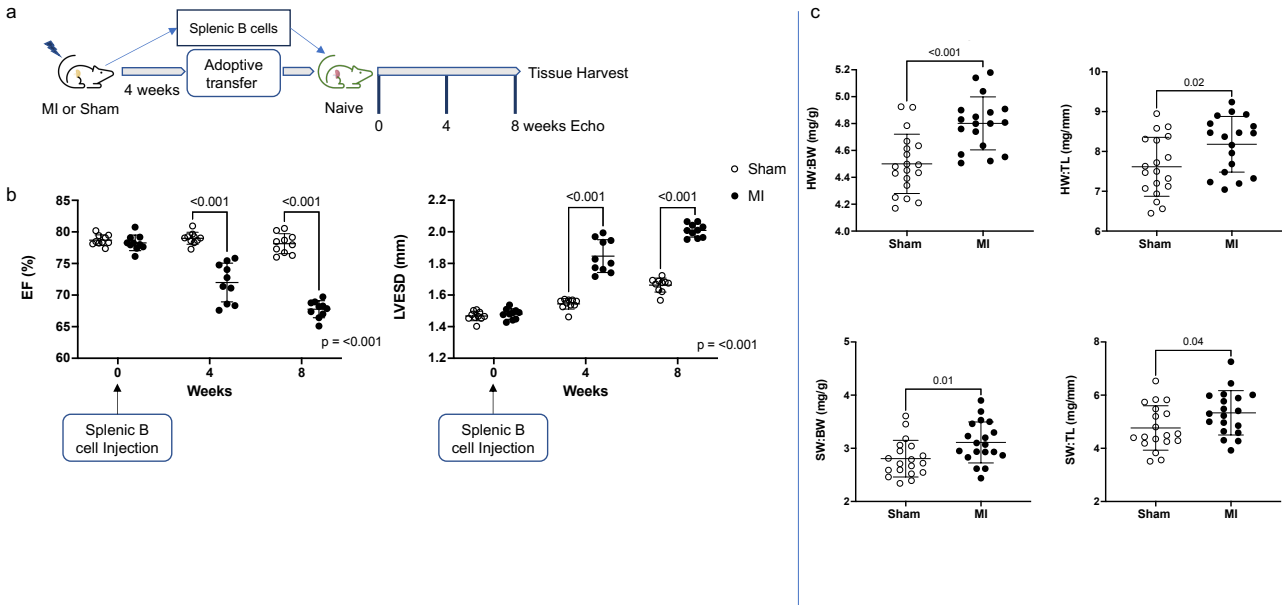
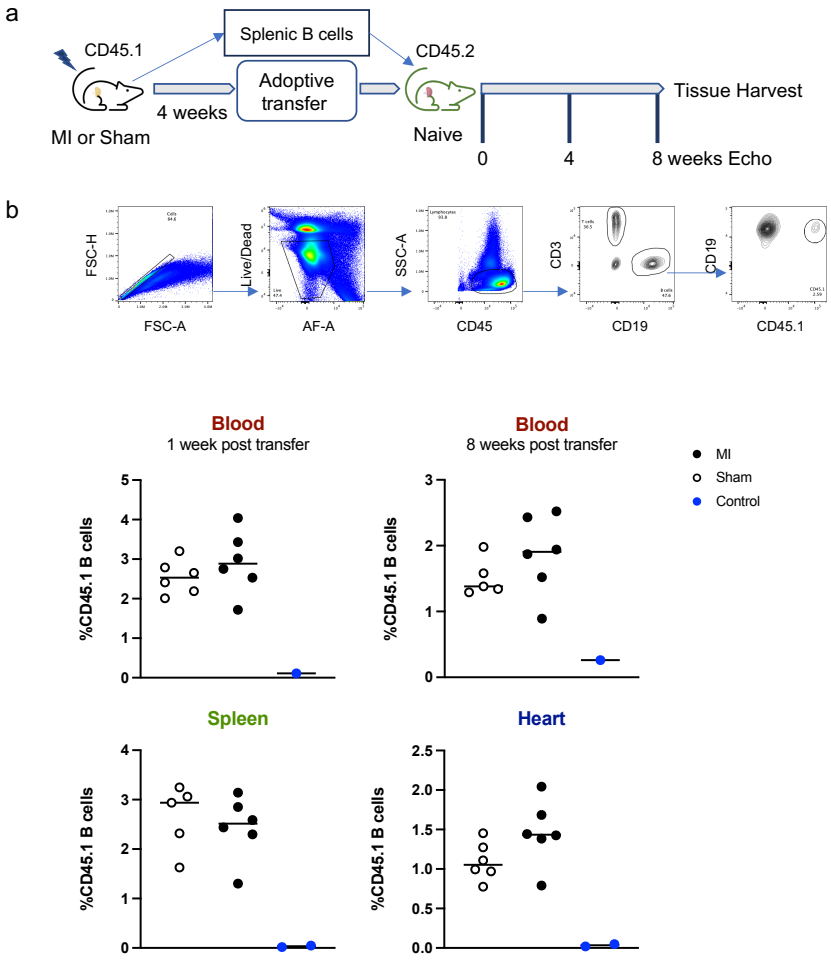
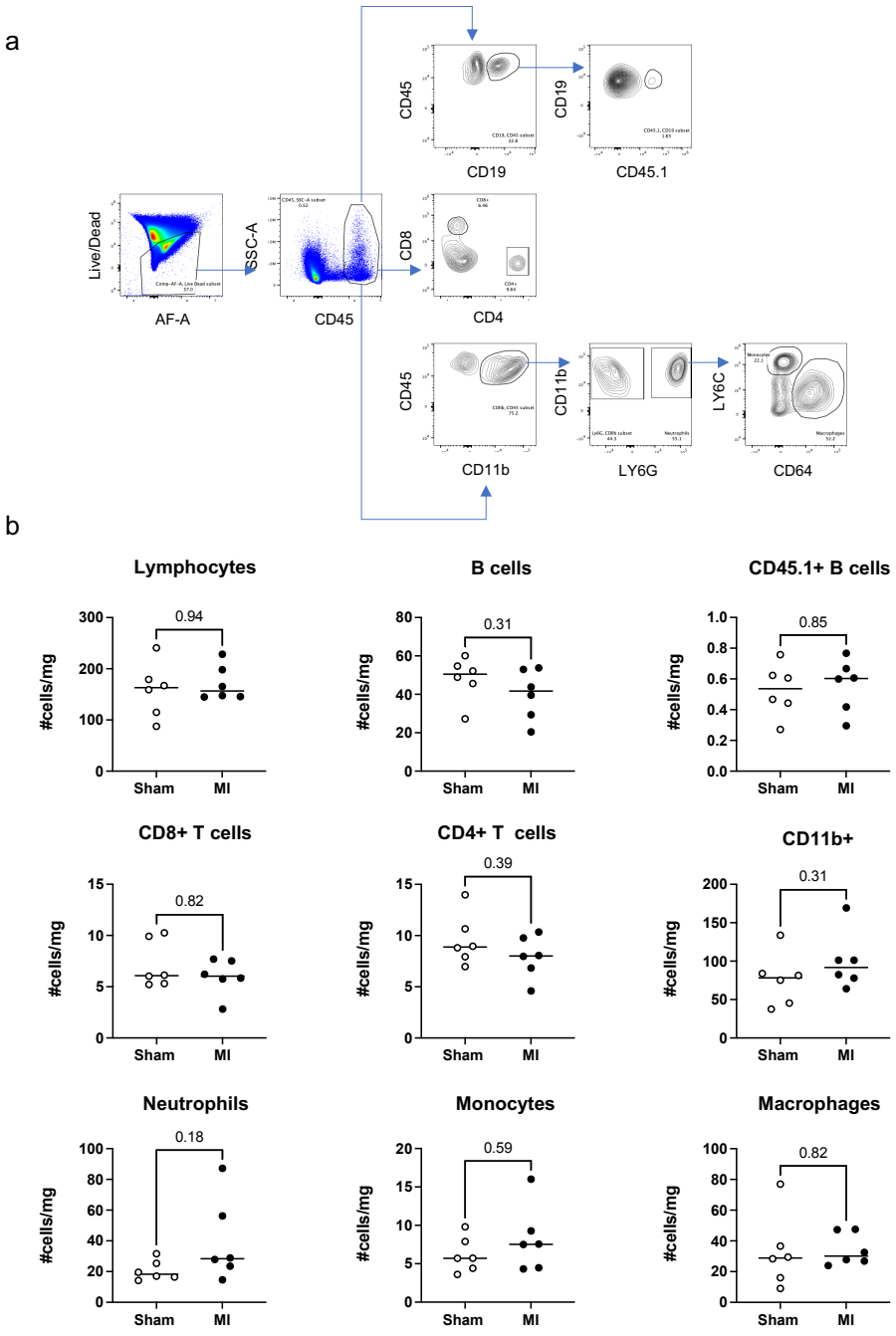
## Extended Data Figures/Tables




**Extended Data Figure 1. Combined analyses from independent splenic B cells adoptive transfer studies.** a) Schema for adoptive transfer of isolated B cells. b) Serial echocardiographic data of recipient mice over eight-week period post-adoptive transfer of isolated splenic B cells (n = 10 per group). c) Combined gravimetric data of recipient mice normalized to body weight and tibia length (n = 21 per group). Mean values ± SD are represented. HW = heart weight. BW = body weight. SW = spleen weight. TL = tibia length.



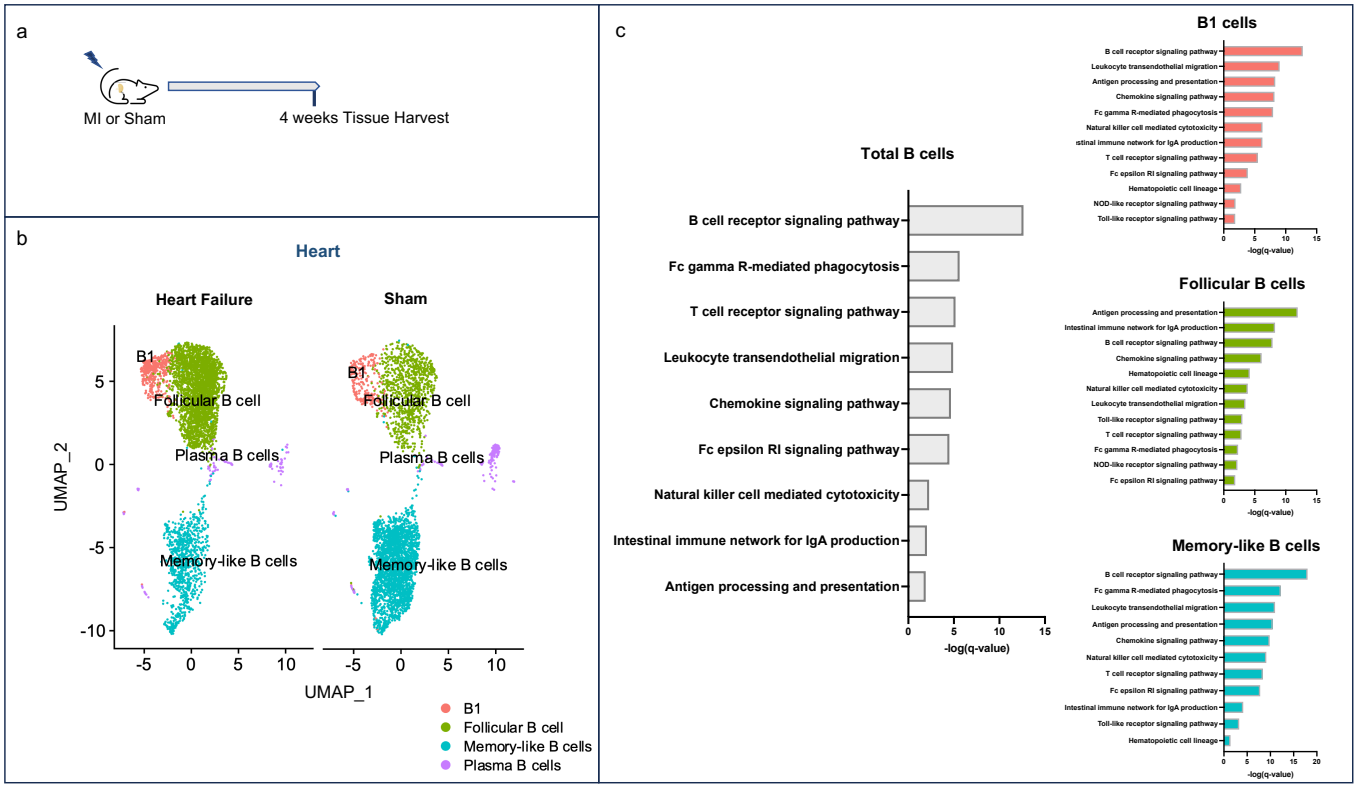

**Extended Data Figure 2. Quantification of CD45.1 donor-derived B cells in a second independent experiment.** a) Representative gating strategy b) Quantification of donor-derived CD45.1 B cells in recipients' peripheral blood, spleen, and hearts. Non-recipient C57BL/6J mice are included as an additional control. Median values are represented by a horizontal mark.



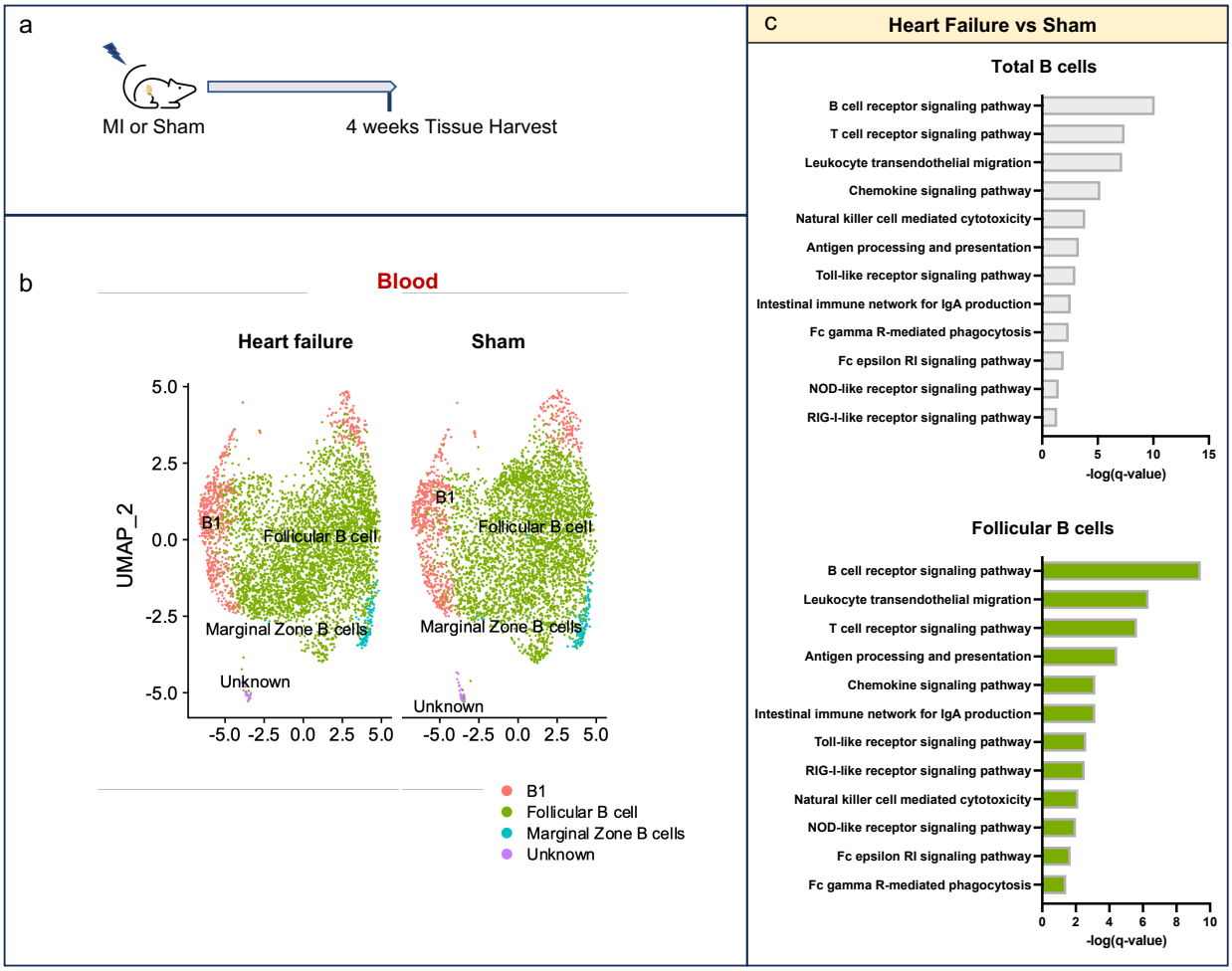

**Extended Data Figure 3. Adoptive transfer of splenic B cells from HF mice did not induce changes in immune cell populations in recipient hearts.** a) Representative gating strategy b) Cardiac immune cell populations of recipient mice eight weeks post-adoptive transfer. n = 6 male mice per group. Median values are represented by a horizontal mark.

| MZB cells | KEGG Term | Count | % | p-value | FDR |
|---|---|---|---|---|---|
| HF | T cell receptor signaling pathway | 5 | 0.0463 | 3.54E-05 | 3.29E-03 |
| | Glycosaminoglycan biosynthesis - keratan sulfate | 2 | 0.1333 | 1.17E-03 | 3.62E-02 |
| | Jak-STAT signaling pathway | 4 | 0.0258 | 1.98E-03 | 3.67E-02 |
| | Purine metabolism | 4 | 0.0252 | 2.17E-03 | 3.67E-02 |

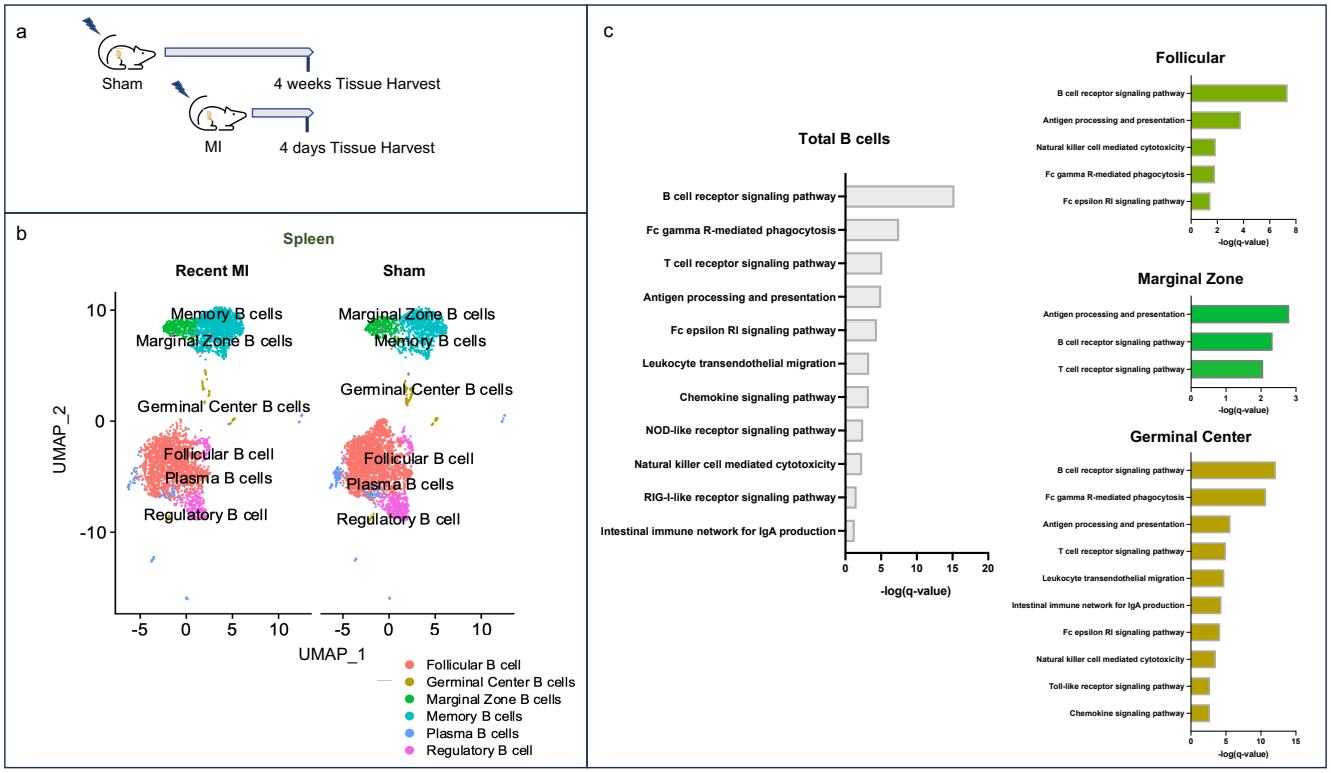
**Extended Data Table 1.** Remote MI does not result in dysregulation of antigen processing and presentation pathways in splenic marginal zone B (MZB) cells. KEGG pathway analysis of differentially expressed genes in splenic MZB cells from heart failure (HF) compared to sham mice ($p<0.05$). Pathways with FDR-adjusted p-value<0.05 are listed.



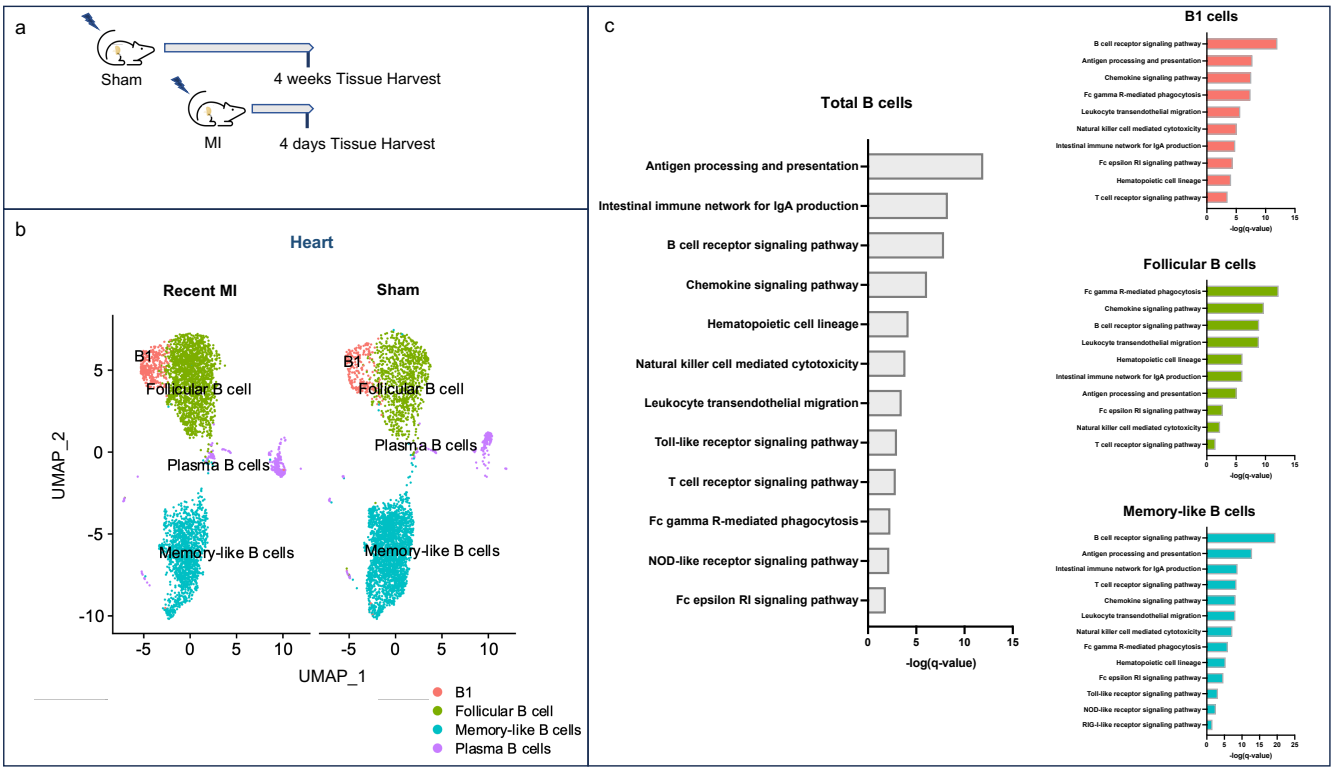

**Extended Data Figure 4. Remote myocardial injury results in dysregulation of antigen processing and presentation in cardiac B cells.** a) Schema for scRNA sequencing of cardiac B cells from mice four weeks post-MI ("heart failure") or sham surgery. b) UMAP plots visualizing cardiac B cell sub-types. c) KEGG pathway analysis of top 500 differentially expressed genes in cardiac B cells from heart failure mice compared to sham mice ($p<0.05$). Immune system pathways for selected B cell subtypes with q-value<0.05 are shown.



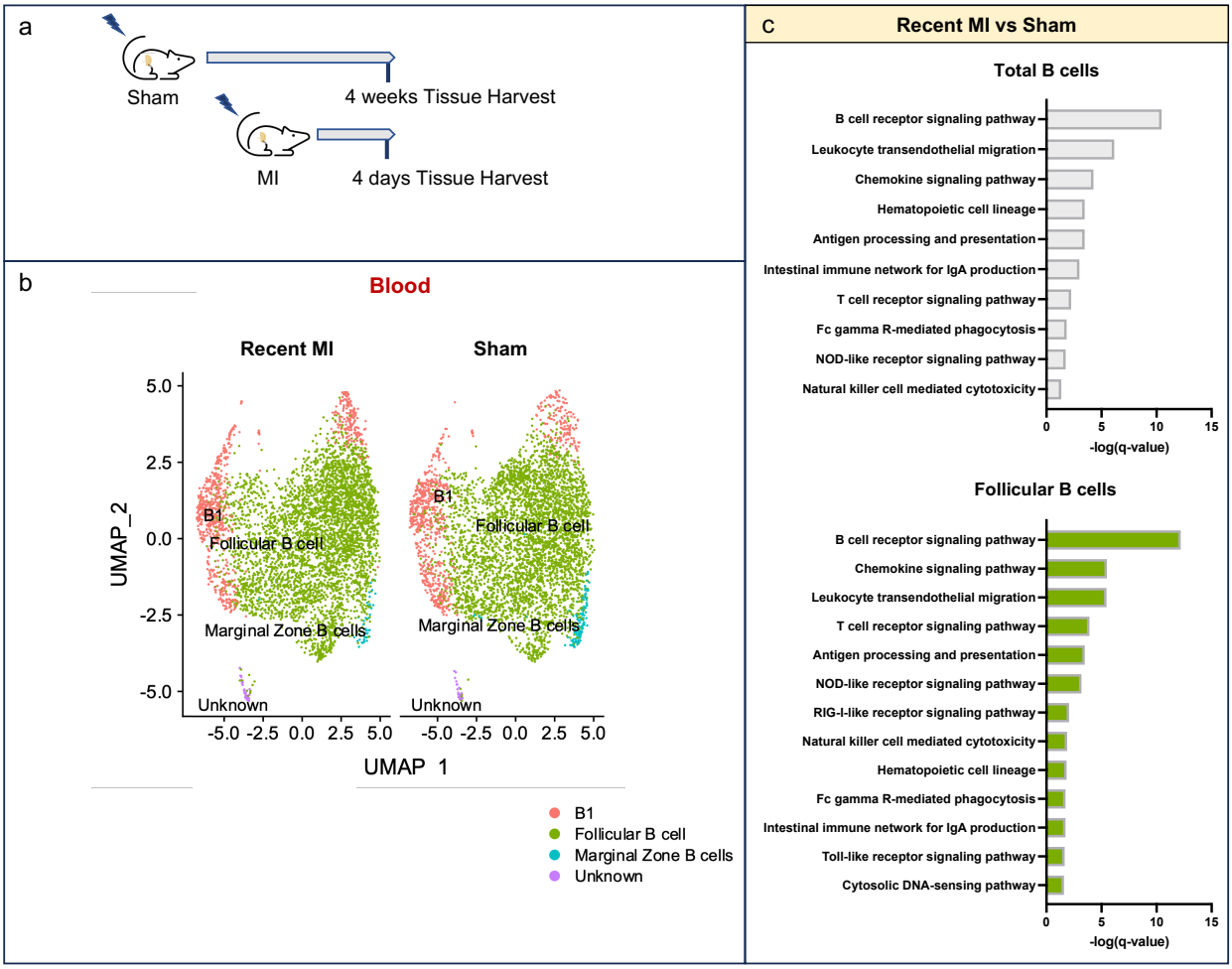

**Extended Data Figure 5. Remote myocardial injury results in chronic dysregulation of antigen processing and presentation in peripheral blood B cells.** a) Schema for scRNA sequencing of peripheral blood B cells from mice four weeks ("heart failure") after permanent coronary ligation or sham surgery. b) UMAP plots visualizing peripheral blood B cell sub-types. c) KEGG pathway analysis of differentially expressed genes in peripheral blood B cells from HF mice compared to sham mice ($p<0.05$). Immune system pathways with q-value<0.05 are shown.



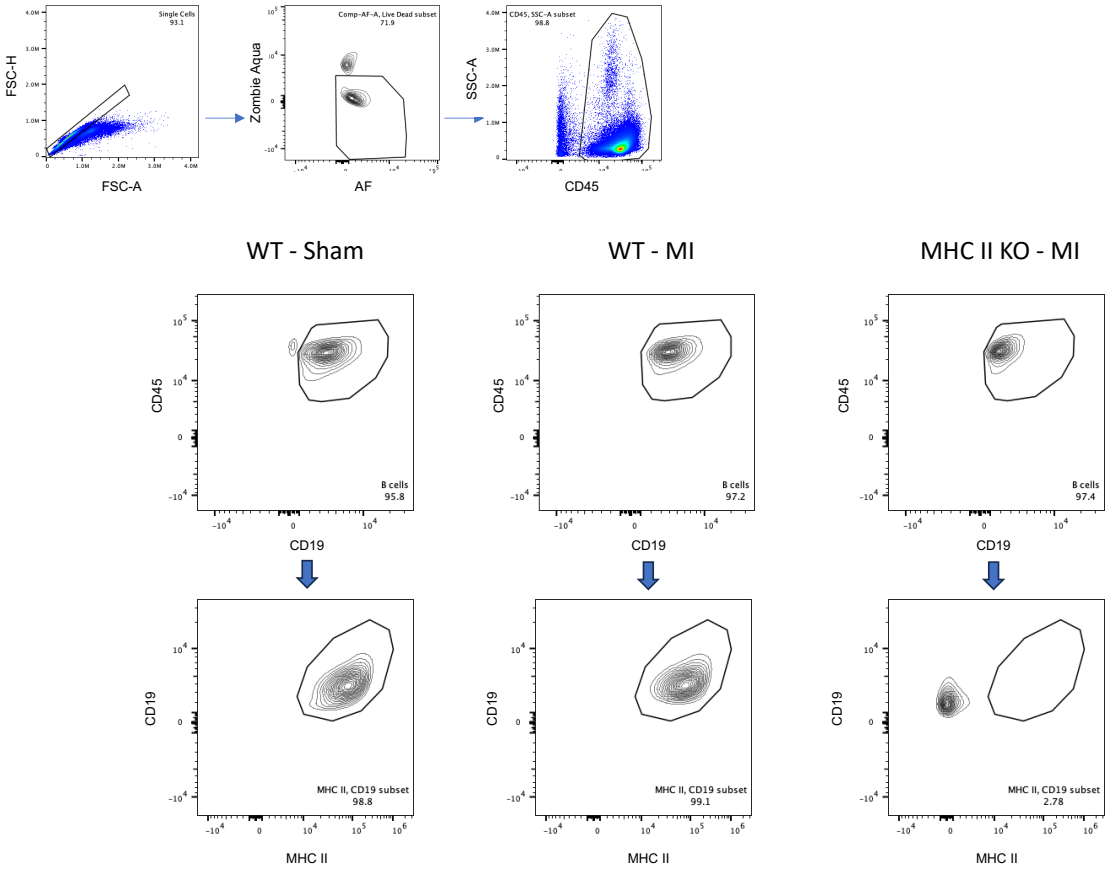

**Extended Data Figure 6. Acute myocardial injury results in dysregulation of antigen processing and presentation in splenic B cells.** a) Schema for single cell sequencing of B cells from mice four days after MI ("recent MI") after permanent coronary ligation or four weeks after sham surgery. b) UMAP plots visualizing splenic B cell sub-types. c) KEGG pathway analysis of differentially expressed genes in splenic B cells from recent MI mice compared to sham mice ($p<0.05$). Immune system pathways for selected B cell subtypes with q-value<0.05 are shown.




**Extended Data Figure 7. <u>Acute myocardial injury</u> results in dysregulation of antigen processing and presentation in <u>cardiac B cells</u>.** A) Schema for single cell sequencing of cardiac B cells from mice four days after MI ("recent MI") after permanent coronary ligation or four weeks after sham surgery. B) UMAP plots visualizing cardiac B cell sub-types. C) KEGG pathway analysis of top 500 differentially expressed genes in cardiac B cells from recent MI mice compared to sham mice ($p<0.05$). Immune system pathways with q-value<0.05 are shown.




**Extended Data Figure 8. Acute myocardial injury results in dysregulation of antigen processing and presentation in peripheral blood B cells.** A) Schema for scRNA sequencing of peripheral blood B cells from mice four days after MI ("recent MI") after permanent coronary ligation or four weeks after sham surgery. B) UMAP plots visualizing peripheral blood B cell sub-types. C) KEGG pathway analysis of differentially expressed genes in peripheral blood B cells from recent MI mice compared to sham mice ($p<0.05$). Immune system pathways with q-value<0.05 are shown.




**Extended Data Figure 9. Confirmation of MHC class II deletion on splenic B cells in transgenic mouse model.** Splenic B cell isolation from *Cd19*$^{tm1(cre)Cgn/}$-*H2-Ab1*$^{b}$-tm1Koni/ *b*-tm1Koni mice and wildtype mice prior to adoptive transfer (four weeks post-MI). Representative FACS plots showing MHC II expression in splenic B cells from the various experimental groups are reported.