Enhancer of zeste homolog 2 (EZH2) has been shown to regulate early B cell development and the differentiation of antibody secreting cells (ASCs). We have previously demonstrated increased EZH2 expression in peripheral blood mononuclear cells isolated from lupus patients, and that pharmacological inhibition of EZH2 alleviates lupus-like disease in mouse models. In this study, we generated a conditional knockout mouse model to delete the gene encoding EZH2 in B cells. We show that EZH2-deficient lupus-prone mice are significantly protected from lupus-like disease, with a reduction in autoantibody production and renal involvement. EZH2 deficiency impairs B cell development by downregulating XBP1 which plays an important role in B cell differentiation.

**Background**

Affinity matured self-reactive antibodies are a hallmark of autoimmune diseases like systemic lupus erythematosus. Earlier studies using a mixed-bone marrow transplant (BM) model system identified spontaneous germinal centers (GC) as sites for epitope spreading.

Moreover, this autoimmune model system revealed that autoreactive GC B cells compete for self-antigen and undergo clonal selection much like that identified for foreign antigen specific B cells. However, the results raised questions about other subsets of autoreactive B cells such as memory B cells (MemBs).

**Methods**

BM from reporter mice (S1PR2 cre_TOM) was mixed with BM from 564 IgI autoimmune mice to generate a model in which spontaneous GC B cells were marked with TOM and were derived primarily from WT background. In parallel, mixed BM chimeras were prepared with WT BM and immunized with a T-dependent antigen. Single cell transcriptomics coupled to antibody repertoire analysis was used to characterize the post germinal center (GC) B cell compartment in the two groups of mice.

**Results**

Antibody secreting cells (ASCs) and memory B cells (MemBs) from spontaneous GCs grouped into multiple subsets. ASCs matured into two terminal clusters, with distinct secretion, antibody repertoire and metabolic profiles. MemBs contained FCRL5+ and CD23+ subsets, with different in vivo localization in the spleen. Interestingly IgM pos GC derived FCRL5+ MemBs share transcriptomic and repertoire properties with atypical B cells found in aging and infection and localize to the marginal zone.

Differential gene expression and repertoire analysis showed that autoreactive MemBs were similar to foreign antigen immune mice.

**Conclusions**

Autoreactive ASC and MemB cells differentiate into subsets similar to that identified in foreign antigen immune mice. Of the two major subsets of MemB, the FCRL5+ subset is primarily IgM pos and localize to the marginal zone. Moreover, clonal redundancy between all MemB and ASC cell clusters was observed.

**Lay Summary**

A mouse model of lupus was used to show that autoreactive B cells form memory similar to those following vaccination. Thus, autoreactive memory B cells are an important therapeutic target.