Supplementary Methods

Flow cytometry

The following antibodies were used in flow cytometry: anti-B220 (RA3-6B2), anti-CD4 (GK1.5), anti-CD8a (53-6.7), anti-CD25 (PC16), anti-CD38 (90), anti-CD69 (H1.2F3), anti-GL7 (GL-7), anti-CD138 (281-2), anti-IgD (11-26c.2a), anti-CD95 (Jo2), anti-PD-1 (J43), anti-IgM (II/41), and anti-CD162 (2PH1). CXCR5 and PNA were stained with biotinylated anti-CXCR5 (2G8) or biotinylated peanut agglutinin (FL10-71), followed by staining with streptavidin-conjugated PE (BD Biosciences).

SCIENTH method

Cells were rested in complete medium at 37ºC for 30 minutes before equally divided into four parts and seeded into 96 well plates. Wells were treated with vehicle or the following metabolic inhibitors for 15 minutes, 2-Deoxy-D-Glucose (2-DG, 100 mM), Oligomycin (Oligo,1 mM), or a sequential combination of the two. Puromycin (10 µg/ml) was then added to each treated well for 15 minutes. Cells were then washed with ice-cold PBS and stained with Fc receptors and viability dye at RM for 15 minutes. Cells were then stained with surface markers in FACS buffer at RM for 20 minutes. Following washing, cells were fixed and permeabilized using the FOXP3 fixation and permeabilization kit (Biolegend) following the manufacturer's instructions. Cells were next stained with anti-Puromycin AF647 (Sigma Aldrich, clone 12D10), resuspended in FACS buffer and read on an Attune NxT (ThermoFisher) cytometer.

T-B coculture assay

628 CD4+ T cells were first enriched from the healthy or SLE donor PMBC using an enrichment kit
629 (STEMCELL, Cat# 17952). The B220-CD3+CD4+CXCR5+PD-1+CXCR3- cells were sorted as
630 Tfh-like cells. Tfh cells (3×104 cells/well) were cultured with anti-human RICTOR- or Ctrl-ASO
631 (10 nm), IL2 (100 U/ml), and IL7 (10 ng/ml) for 5 days. CD19+ B cells were next enriched from
632 same donor PBMC using an enrichment kit (STEMCELL, Cat# 17854). CD19+IgD-CD27+
633 CD38- cells were next sorted as memory B cells (2×104 cells/well) and seeded to coculture with
634 ASO treated Tfh cells in the presence of staphylococcal enterotoxin B (SEB, 100ng/ml, Toxin
635 Technology) for 7 days.

636 **Supplementary Table 1. Demographic and clinical characteristics of SLE patients***

Patient	**1**	**2**	**3**	**4**	**5**
Age (years)	57	36	55	67	53
Gender	Female	Male	Female	Female	Female
Race/Ethnicity	White non-Hispanic	White non-Hispanic	White non-Hispanic	White non-Hispanic	White non-Hispanic
SLE duration (Years)	28	12	7	12	19
SLEDAI 2k Score	9	10	10	4	0
Autoantibodies					
ANA	+	+	+	+	+
Anti-Sm	-	+	-	+	-
Anti-RNP	+	-	-	+	-
Anti-Ro	+	-	-	-	-
Anti-La	+	-	-	-	-
Anti-dsDNA	+	+	-	-	-
aCL IgM / IgG	-	Not available	Not available	+/+	-
β2GP1 I IgM / IgG	-	Not available	Not available	-	-
Lupus anticoagulant	-	Not available	Not available	-	+
Complement C3/4	Low	Normal	Normal	Normal	Normal
Organ Involvement					
Joints	+	+	+	+	+
Constitutional	-	-	-	-	-
Hematologic	+	-	-	-	+
Mucocutaneous	-	+	+	-	+
Kidney	-	-	-	-	-
Serosal	+	-	-	-	-
Neuropsychiatric	-	-	-	-	-
Treatments					
Glucocorticoids	+	+	-	+	-
HCQ	+	-	+	+	+
Mycophenolate	-	-	-	-	-
Methotrexate	-	-	+	+	-
Azathioprine	-	-	-	+	+
Others	None	None	None	None	None

637

638 *All patients met ACR/EULAR SLE criteria.

639 Abbreviations: ANA=antinuclear antibodies; dsDNA=anti-double-stranded DNA antibody;
640 RNP=anti-Ribonucleoprotein antibody. Sm=anti-Smith antibody; Ro=anti-Ro antibody; La=anti-
641 La antibody; SCL70= anti-topoisomerase I; RF= Rheumatoid Factor. ACCP= Anti-cyclic
642 citrullinated peptide, aCL = anticardiolipin; anti-β2GPI = anti–β2-glycoprotein I, HCQ=
643 Hydroxychloroquine.
644

Supplementary figure legend

Supplementary Figure 1: Flow analysis of splenocyte cell populations in IMQ mice.

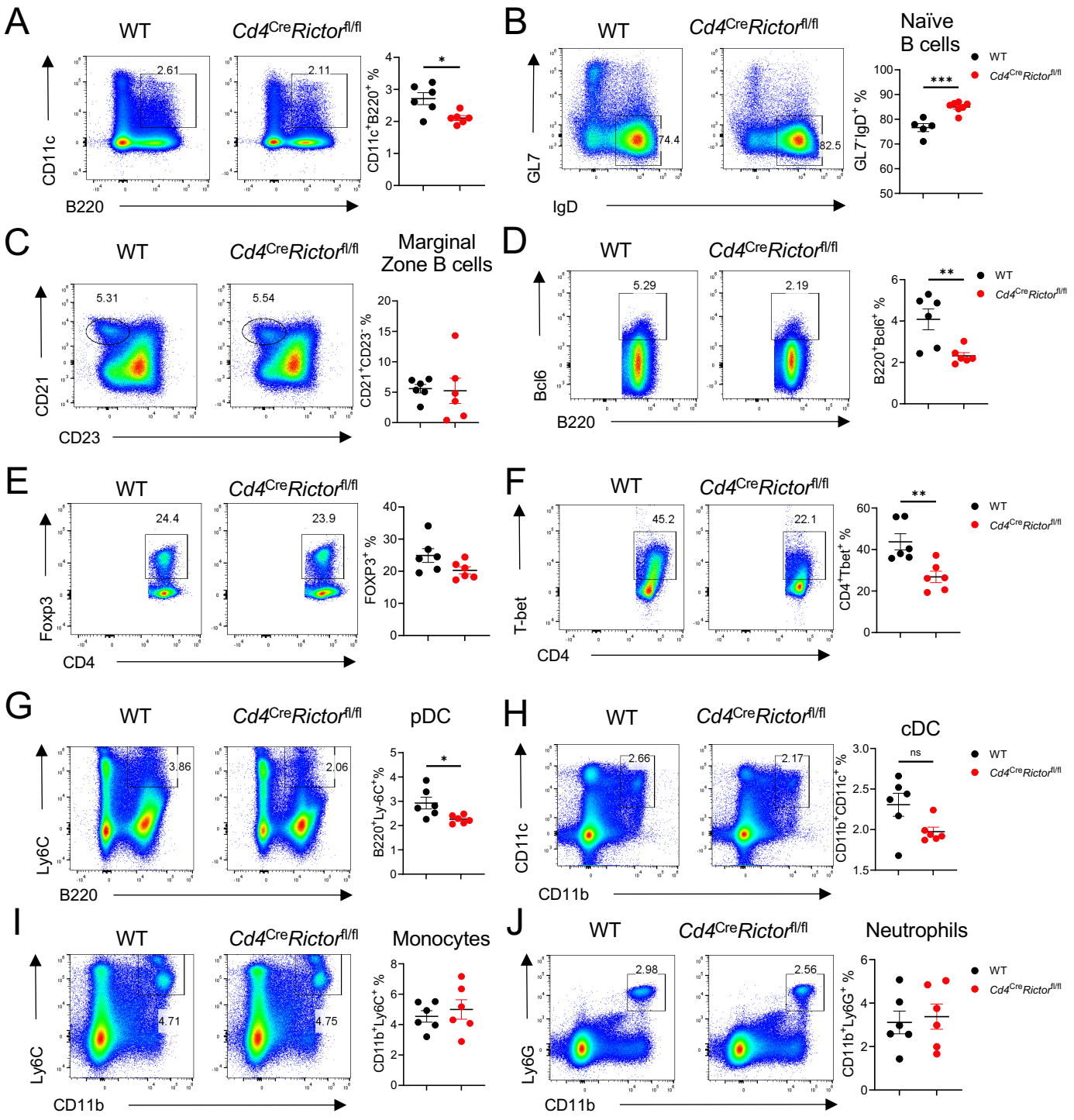
(A) Expression of GL7 and IgD in splenocyte. Right, frequency of $GL7^{-}IgD^{+}$ naïve B cells. (B) Expression of CD21 and CD23 in splenocyte. Right, frequency of $CD21^{+}CD23^{-}$ marginal zone B cells. (C) Expression of Bcl6 and B220 in splenocyte. Right, frequency of $B220^{+}Bcl6^{+}$ cells. (D) Expression of CD11c and B220 in splenocyte. Right, frequency of $CD11c^{+}B220^{+}$ cells. (E) Expression of Foxp3 and CD4 in splenocyte. Right, frequency of $Foxp3^{+}$ cells within $CD4^{+}$ cells. (F) Expression of T-bet and CD4 in splenocyte. Right, frequency of $CD4^{+}T\text{-}bet^{+}$ cells within $CD4^{+}$ cells. (G) Expression of Ly6C and B220 in splenocyte. Right, frequency of $B220^{+}Ly6C^{+}$ pDC cells. (H) Expression of CD11c and CD11b in splenocyte. Right, frequency of $CD11c^{+}$ $CD11b^{+}$ cDC cells. (I) Expression of Ly6C and CD11b in splenocyte. Right, frequency of $CD11b^{+}Ly6C^{+}$ monocytes. (J) Expression of Ly6G and CD11b in splenocyte. Right, frequency of $CD11b^{+}Ly6G^{+}$ neutrophils. $*p < 0.05$, $**p < 0.01$, $***p < 0.001$. p-Values were calculated with unpaired student t-tests. Error bars represent SEM.

Supplementary Figure 2: Flow analysis of peripheral lymphocytes in Lpr-*Ifnar1*$^{-/-}$ **mice.**

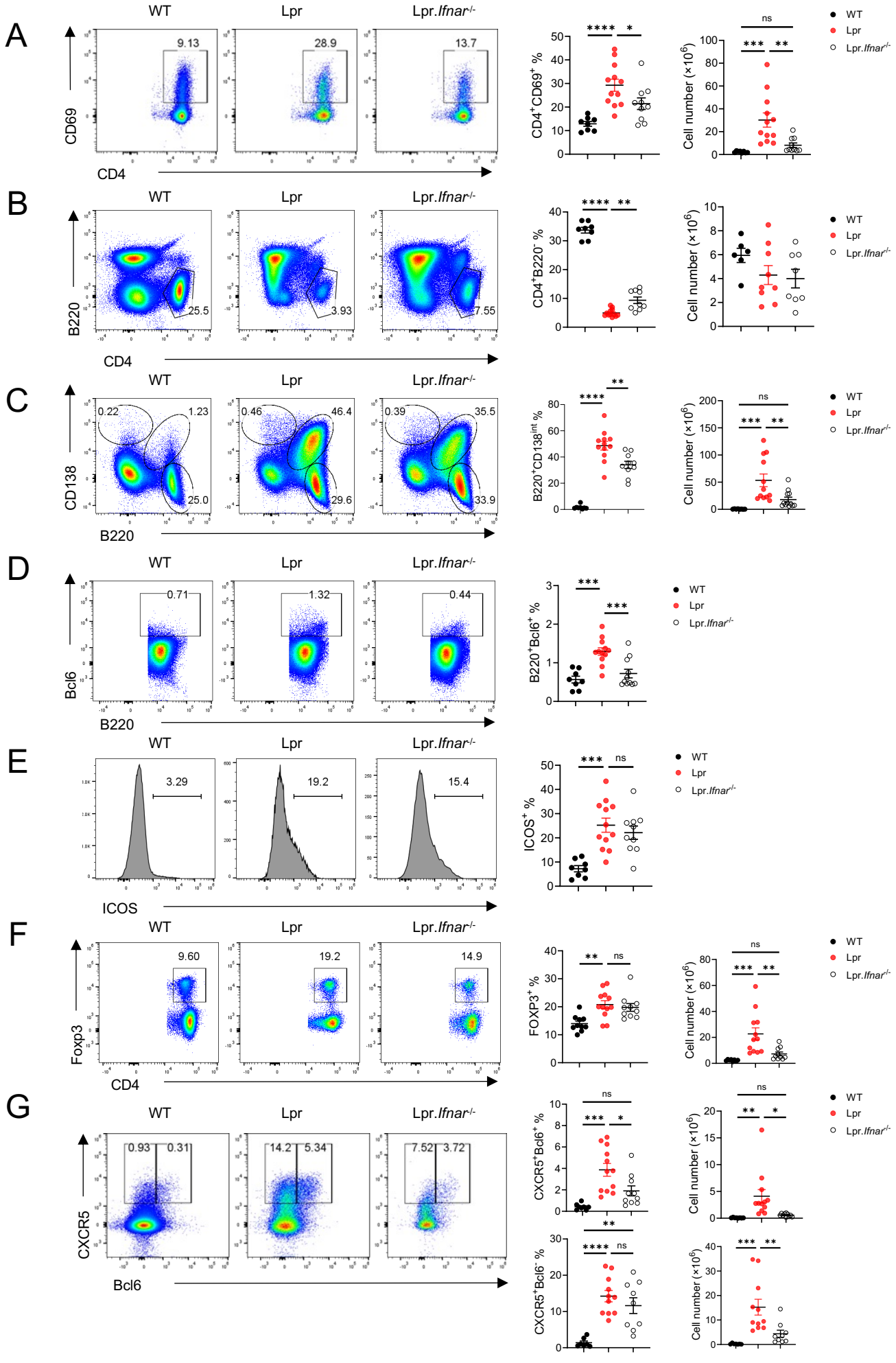
(A) Expression of CD69 and CD4 in pLN derived lymphocytes. Left, frequency of $CD4^{+}CD69^{+}$ population; right absolute cell number of $CD4^{+}CD69^{+}$ cells in pLN. (B) Expression of B220 and CD4 in pLN derived lymphocytes. Left, frequency of $CD4^{+}B220^{-}$ population; right absolute cell number of $CD4^{+}B220^{-}$ cells in pLN. (C) Expression of B220 and CD138 in pLN derived lymphocytes. Left, frequency of $B220^{+}CD138^{hi}$ population; right absolute cell number of $B220^{+}CD138^{hi}$ cells in pLN. (D) Expression of B220 and Bcl6 in pLN derived lymphocytes. Right, frequency of $B220^{+}Bcl6^{+}$ population in pLN. (E) Expression of ICOS on $CD4^{+}$ cells in pLN. (F)

668 Expression of Foxp3 and CD4 in pLN derived lymphocytes. Left, frequency of $CD4^+Foxp3^+$
669 population; right absolute cell number of $CD4^+Foxp3^+$ cells in pLN. (G) Expression of CXCR5
670 and Bcl6 in pLN derived lymphocytes. Upper left, frequency of $CXCR5^+Bcl6^+$ population; upper
671 right, absolute cell number of $CXCR5^+Bcl6^+$ cells in pLN. Lower left, frequency of $CXCR5^+Bcl6^-$
672 population; lower right, absolute cell number of $CXCR5^+Bcl6^-$ cells in pLN. Results were pooled
673 from at least 3 independent experiments. ns, not significant; *p < 0.05, **p < 0.01, ***p < 0.001,
674 ****p < 0.0001. p-Values were calculated with one-way ANOVA with the post-hoc Tukey test.
675 Error bars represent SEM.
676
677 **Supplementary Figure 3: Flow analysis of peripheral lymphocytes in Ctrl-/*RICTOR*-ASO**
678 **treated MRL/*lpr* mice.** (A) Peripheral lymph node size (left) and derived lymphocyte cell
679 numbers (Right) in treated mice. (B) Expression of CD4 and CD8 in pLN derived lymphocytes.
680 Right, percentage of $CD4^+$ population in pLN. (C) Expression of CD4 and CD69 in pLN derived
681 lymphocytes. Right, frequency of $CD4^+CD69^+$ population in pLN. *p < 0.05, **p < 0.01. p-Values
682 were calculated with unpaired student t-tests. Error bars represent SEM.
683
684 **Supplementary Figure 4: Supernatant immunoglobulin isotypes concentration of T-B culture**
685 **derived from healthy donor PBMCs.** ns, not significant, *p < 0.05, **p < 0.01. p-Values were
686 calculated with paired t-tests. Error bars represent SEM.

Supplementary Figure 1



Supplementary Figure 2



Supplementary Figure 3

Supplementary Figure 4