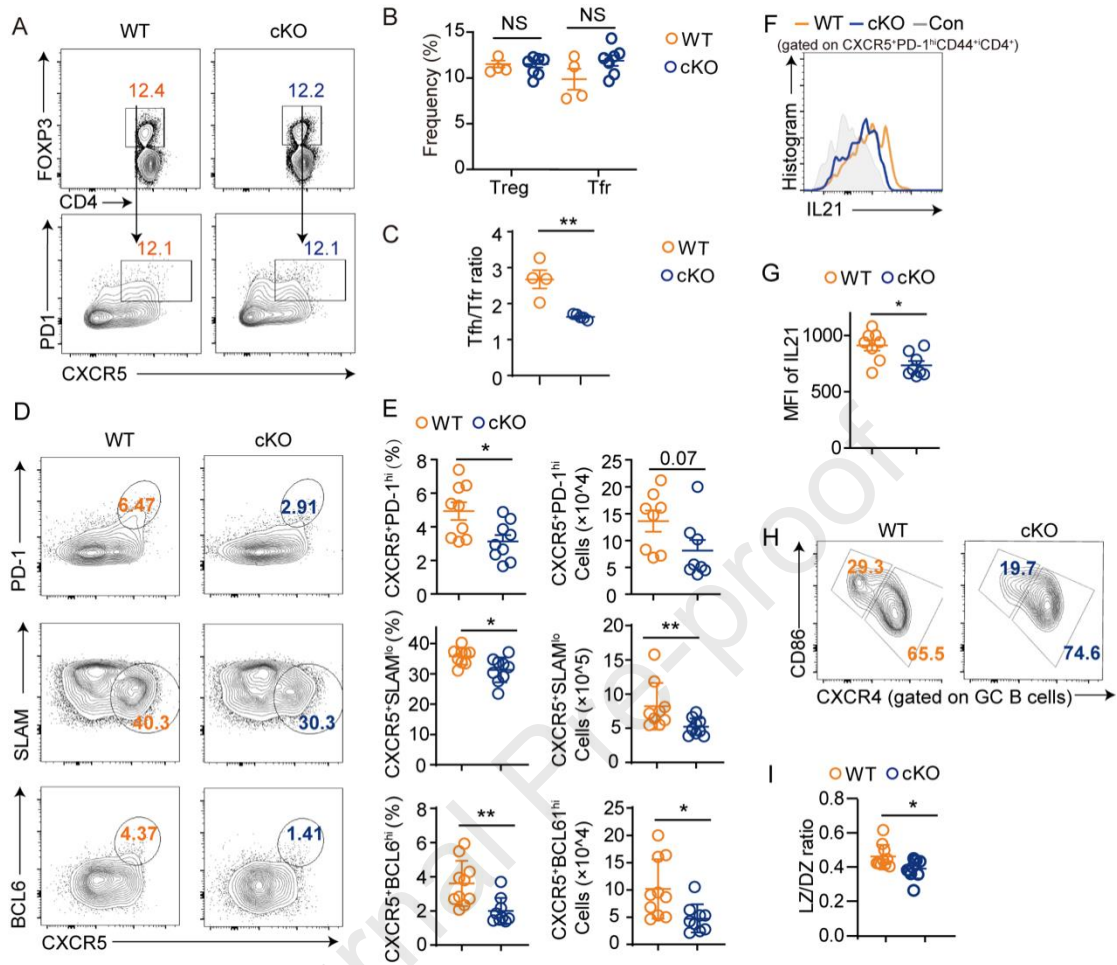


1108 **Supplemental Figure 1**



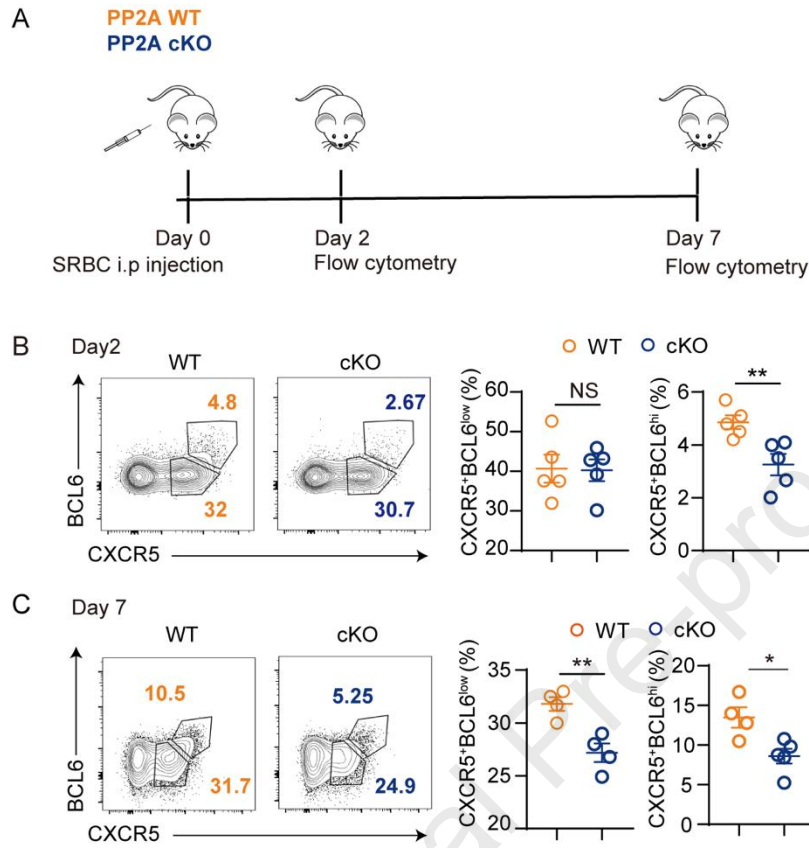
1109

1110 **Supplemental Figure 1. Impaired Tfh induction in PP2A cKO mice of NP-**  
 1111 **KLH immunization model**

1112 **(A)** Representative flow cytometric analysis of Treg and Tfr cells from mice  
 1113 immunized with SRBC on day 7. **(B)** Frequencies of populations in **A** . **(C)** The  
 1114 ratios of Tfh/Tfr for the indicated genotype. **(D-I)** PP2A WT and cKO mice were  
 1115 immunized with NP-KLH with Alum and analyzed on day 14 (n = 8-14 mice per  
 1116 genotype). **(D)** Representative flow cytometric plots of CXCR5+PD1<sup>hi</sup>,  
 1117 CXCR5+SLAM<sup>lo</sup>, CXCR5+BCL6<sup>hi</sup> populations among CD44<sup>+</sup>CD4<sup>+</sup> T cells for the

1118 indicated genotype. **(E)** Frequencies and cell numbers of populations in **D**. **(F)**  
1119 Representative flow cytometric plots of IL21 expression gated on  
1120 CXCR5<sup>+</sup>PD1<sup>+</sup>CD44<sup>+</sup>CD4<sup>+</sup> T cells for the indicated genotype. **(G)** Statistical  
1121 analysis of MFI of IL21 in **F**. **(H)** Representative flow cytometric plots of LZ GC  
1122 B (CD86<sup>+</sup>) and DZ GC B (CXCR4<sup>+</sup>) cells for the indicated genotype. **(I)**  
1123 Statistical analysis of LZ/DZ ratio in **H**. Each dot represents one individual  
1124 mouse. Data are representative of two independent experiments and analyzed  
1125 by two-sided student's t-test. Error bars of Means  $\pm$  SEM. NS, not significant;  
1126 \* $p$ <0.05; \*\* $p$ <0.01; \*\*\* $p$ <0.001.

1127 **Supplemental Figure 2**



1128

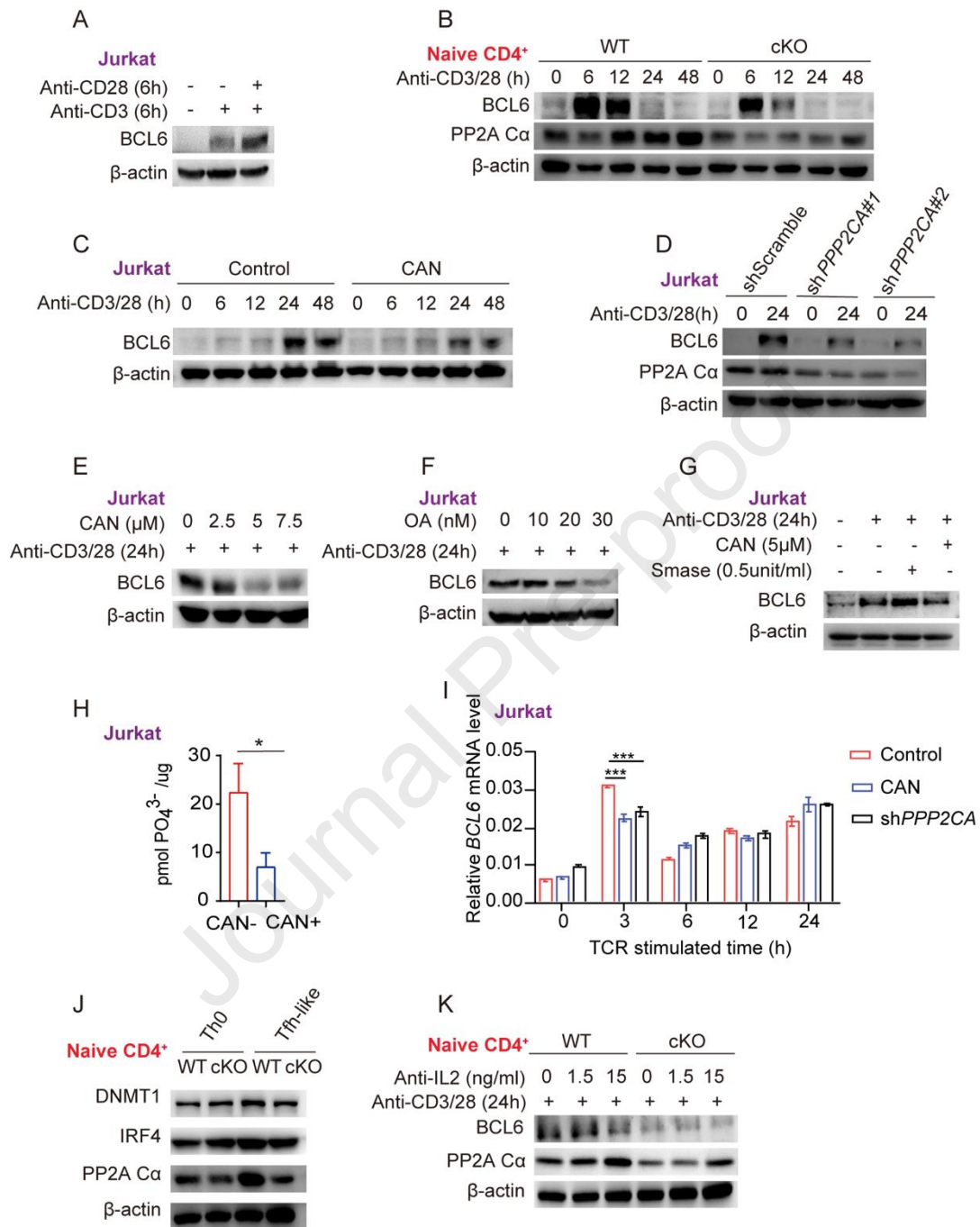
1129 **Supplemental Figure 2. Pre-Tfh analysis during the time course of SRBC**  
1130 **immunization**

1131 **(A)** Schematic diagram of experimental design. Mice were immunized with  
1132 SRBCs and analyzed on day 2 and day 7 (n = 4-5 mice per genotype). **(B and**  
1133 **C)** Representative flow cytometry plots of pre-Tfh  
1134 (CXCR5<sup>+</sup>BCL6<sup>low</sup>CD44<sup>+</sup>CD4<sup>+</sup>) and Tfh (CXCR5<sup>+</sup>BCL6<sup>hi</sup>CD44<sup>+</sup>CD4<sup>+</sup>) cells at  
1135 the two different time points as illustrated in **A**. Each dot represented one  
1136 individual mouse. Data are representative of two independent experiments and

1137 analyzed by two-sided student's t-test. Error bars of Means  $\pm$  SEM. NS, not  
1138 significant; \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

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1139 **Supplemental Figure 3**



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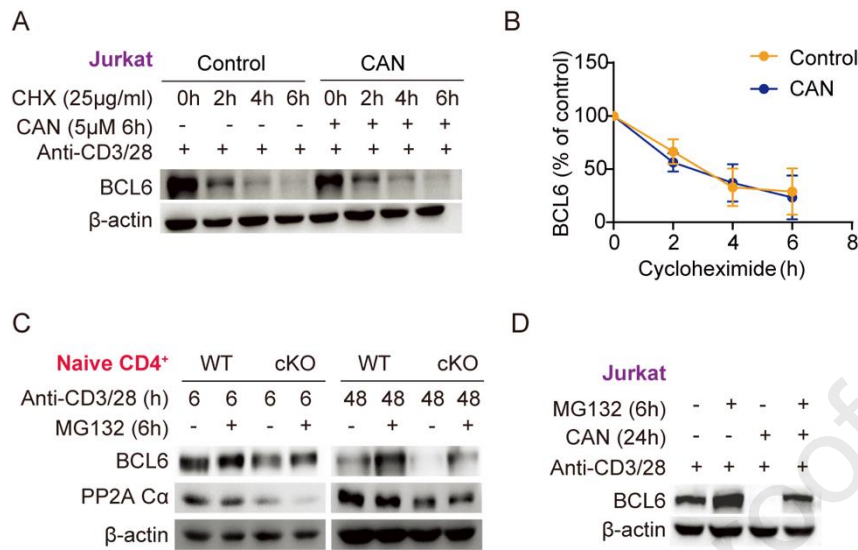
1141 **Supplemental Figure 3. PP2A Ca controls BCL6 protein expression but**  
 1142 **not transcription**

1143 **(A)** Jurkat cells were cultured under indicated conditions for 24 hours. The  
1144 expression of BCL6 and PP2A C $\alpha$  was analyzed by western blotting. **(B-C)**  
1145 Naive CD4<sup>+</sup> T cells from PP2A WT or cKO mice or Jurkat cells cocultured with  
1146 or without CAN (5 $\mu$ M) were stimulated with anti-CD3/28 antibodies for the  
1147 indicated time. The expression of BCL6 and PP2A C $\alpha$  was analyzed by western  
1148 blotting. **(D)** PP2A C $\alpha$  was knockdown in Jurkat cells by shRNA and stimulated  
1149 with anti-CD3/28 antibodies for the indicated time. The expression of BCL6 and  
1150 PP2A C $\alpha$  was analyzed by western blotting. **(E-F)** Jurkat cells were cocultured  
1151 with indicated concentrations of PP2A inhibitor CAN or OA and stimulated with  
1152 anti-CD3/28 antibodies for 24 hours. The expression of BCL6 was analyzed by  
1153 western blotting. **(G)** Jurkat cells treated with PP2A inhibitor CAN or PP2A  
1154 activator SMase and stimulated with anti-CD3/28 antibodies for 24 hours. The  
1155 expression levels of BCL6 were analyzed by western blotting. **(H)** Jurkat cells  
1156 were cocultured with or without PP2A inhibitor CAN (5 $\mu$ M) for 24 hours. The  
1157 PP2A dephosphorylation activity was measured from the lysate of the treated  
1158 Jurkat cells. **(I)** Jurkat cells treated with PP2A inhibitor CAN or transfected with  
1159 sh*PPP2CA* were cultured under anti-CD3/28 stimulation for the indicated time.  
1160 The expression of *BCL6* mRNA was measured by qPCR. **(J)** Naive CD4<sup>+</sup> T  
1161 cells were cultured under Th0 or Tfh-like condition. The expression of DNMT1,  
1162 IRF4, and PP2A C $\alpha$  was analyzed by western blotting. **(K)** Naive CD4<sup>+</sup> T cells  
1163 were cultured with anti-IL2 neutralizing antibodies for the indicated  
1164 concentration and stimulated with anti-CD3/28 antibodies for 24 hours. The

1165 expression of BCL6 and PP2A C $\alpha$  was analyzed by western blotting. Data are  
1166 representative of two independent experiments and analyzed by two-sided  
1167 student's t-test; Error bars of Means  $\pm$  S.D. \* $p$ <0.05; \*\* $p$ <0.01; \*\*\* $p$ <0.001.

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1168 **Supplemental Figure 4**



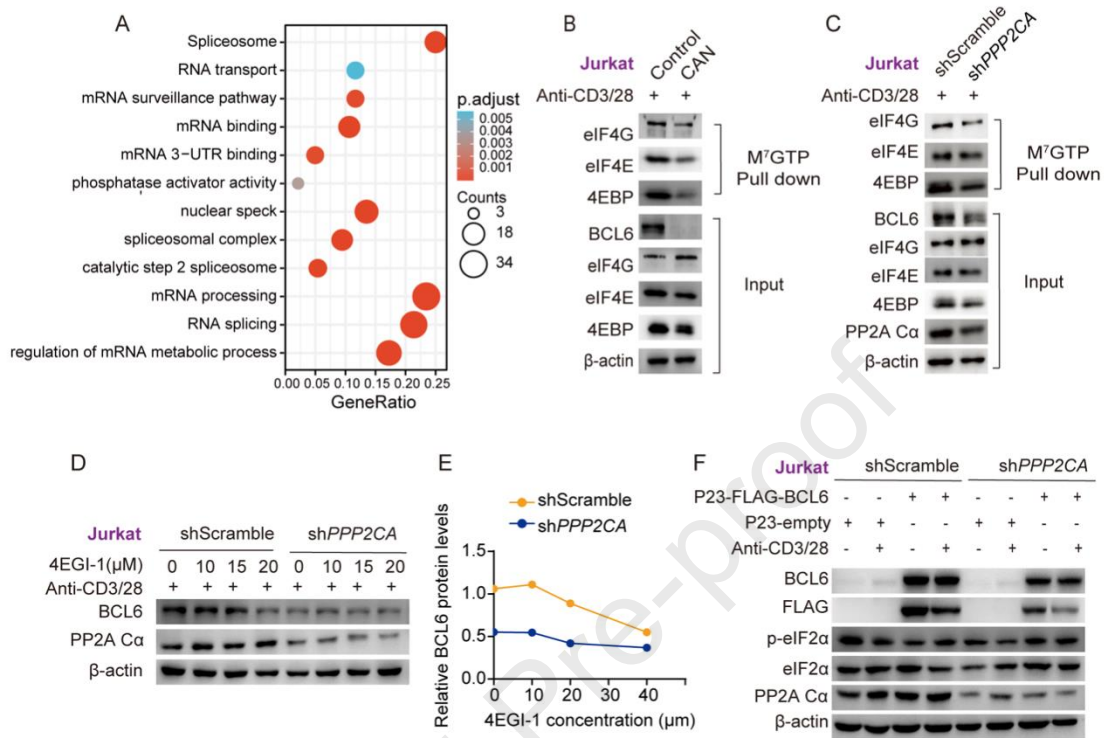
1169

1170 **Supplemental Figure 4. Protein degradation of BCL6 is unaffected in**  
 1171 **PP2A deficient T cells**

1172 **(A)** Jurkat cells were stimulated with anti-CD3/28 antibodies and treated with or  
 1173 without PP2A inhibitor CAN. BCL6 protein stability was evaluated by the cells  
 1174 cultured with vehicle or cycloheximide (100 µg/ml) for the indicated time by  
 1175 western blotting. **(B)** Quantification of BCL6 signal intensity by densitometry  
 1176 over the time course of cycloheximide treatments from **A**. The levels of BCL6  
 1177 in the vehicle-treated controls were set as 100%. **(C)** Naive CD4<sup>+</sup> T cells from  
 1178 PP2A WT or cKO mice or **(D)** Jurkat cells were cultured under anti-CD3/28  
 1179 antibodies stimulation for the indicated time and MG132 (20µM) was added in  
 1180 the last 6 hours. The expression of BCL6 was analyzed by western blotting.  
 1181 Data are representative of two independent experiments and analyzed by two-  
 1182 sided student's t-test. Error bars of Means ± S.D. \* $p < 0.05$ ; \*\* $p < 0.01$ ;  
 1183 \*\*\* $p < 0.001$ .



1184 **Supplementary Figure 5**



1185

1186 **Supplemental Figure 5. Protein synthesis of BCL6 is decreased in PP2A**

1187 **Cα deficiency**

1188 **(A)** KEGG hallmark gene sets enrichment analysis was performed on 371

1189 published proteins, whose Ser/Thr phosphorylation levels were significantly

1190 changed by comparing CD3-stimulated PP2A-deficient thymocytes to their

1191 CD3-stimulated WT controls. Ser/Thr phosphor-peptide profiling was measured

1192 by a phosphoproteomics assay (mass spectrometry-based iTRAQ phosphor-

1193 peptide analysis). **(B)** Assembly of the eIF4F complex was evaluated by

1194 western blotting after M<sup>7</sup>GTP immunoprecipitation using extracts from anti-

1195 CD3/28 antibodies activated Jurkat cells cultured with or without PP2A inhibitor

1196 CAN for 24 hours. **(C)** Assembly of the eIF4F complex was evaluated by  
1197 western blotting after M<sup>7</sup>GTP immunoprecipitation using extracts from anti-  
1198 CD3/28 antibodies activated Jurkat cells transfected with shScramble or  
1199 shPPP2CA for 24 hours. **(D)** Jurkat cells transfected with shScramble or  
1200 shPPP2CA were cultured with anti-CD3/28 antibodies stimulation and treated  
1201 with vehicle control or the indicated doses of 4EGI-1 for 24 hours. The  
1202 expression of BCL6 was analyzed by western blotting. **(E)** Quantification of  
1203 BCL6 signal intensity by densitometry over the time course of 4EGI-1 treatment.  
1204 The levels of  $\beta$ -actin were set as control. **(F)** Jurkat cells were then transfected  
1205 with shScramble or shPPP2AC for the indicated condition and assessed the  
1206 levels of BCL6, FLAG, and phosphorylation status of eIF2 $\alpha$  by western blotting.  
1207 Data are representative of at least two independent experiments with similar  
1208 results.

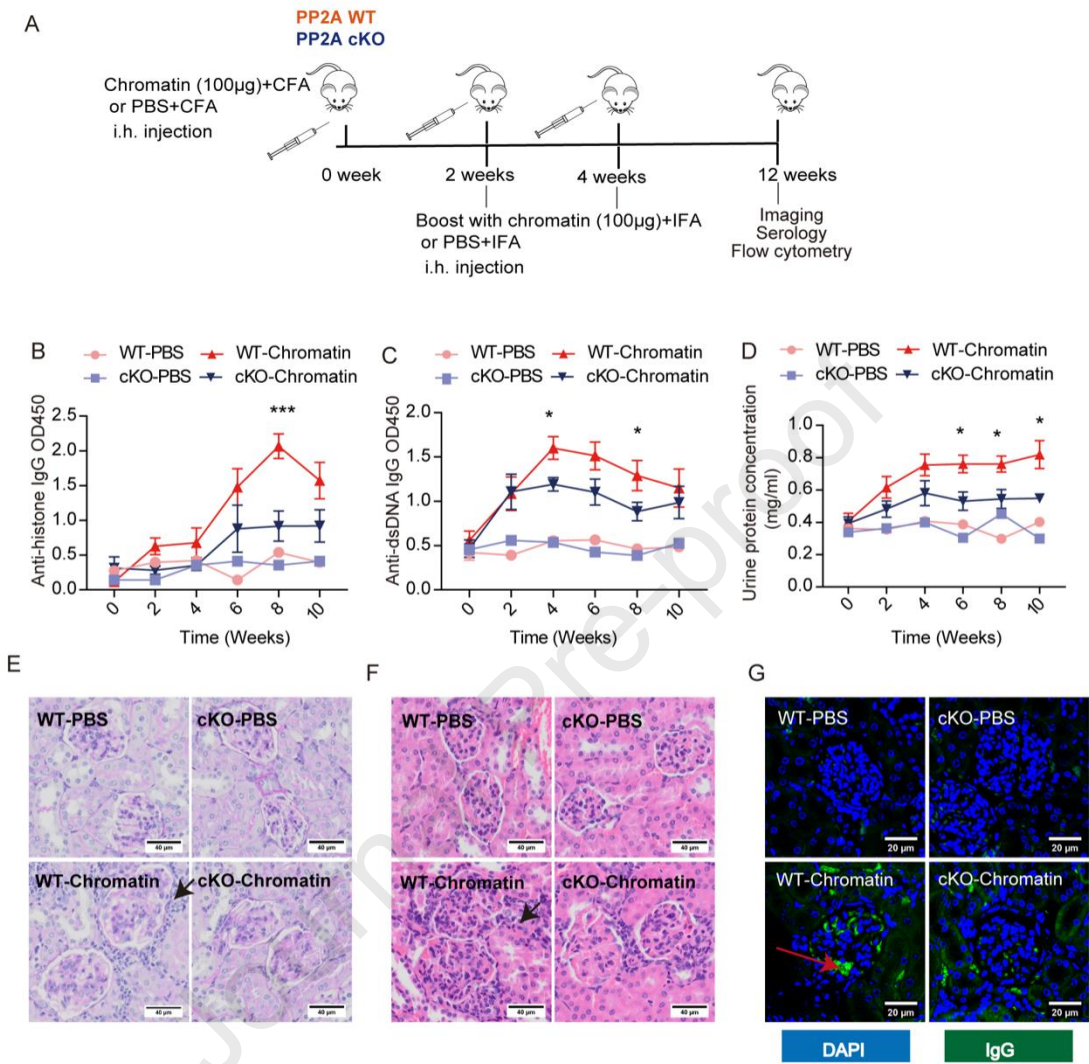


1213 **(A-C)** Western blot analysis of S6K, and p-S6K (Ser371) or p-S6K (Thr389)  
1214 levels from PP2A WT and cKO naive CD4<sup>+</sup> T cells which were stimulated with  
1215 anti-CD3/28 antibodies for the indicated time. BCL6 was evaluated at 6 hour  
1216 time point. **(D)** Western blot analysis of 4EBP, p-4EBP(Thr70), S6K, and p-S6K  
1217 (Thr389) in scramble or shPPP2CA#1 shRNA transduced Jurkat cells. Cells  
1218 were stimulated with anti-CD3/28 antibodies for the indicated time. **(E)** Western  
1219 blot analysis of the BCL6, S6K, and p-S6K levels from PP2A WT and cKO naive  
1220 CD4<sup>+</sup> T cells which were treated with or without Rapa (20 $\mu$ M) and stimulated  
1221 with anti-CD3/28 antibodies for 6 hours. **(F)** PMX-HA-*ppp2ca* or PMX-empty  
1222 constructs were transfected in WT or cKO naïve CD4<sup>+</sup> T cells. Cells were either  
1223 stimulated or unstimulated with the plate bounded anti-CD3/28 antibodies for  
1224 24 hours. The expression of BCL6, HA, and PP2A C $\alpha$  was analyzed by western  
1225 blotting. **(G)** Flow cytometry analysis of p-S6 (Ser235/236) and p-4EBP  
1226 (Thr37/46) in Jurkat T cells transfected with shScramble, shPPP2CA#1 or  
1227 shPPP2CA#2, or treated with CAN (5 $\mu$ M). Cells were stimulated with or without  
1228 anti-CD3 plus anti-CD28 (2 $\mu$ g/ml) for 24 hours. **(H)** Quantification of the MFI of  
1229 the proteins measured in G. **(I)** Flow cytometry analysis of p-S6 (Ser235/236)  
1230 and p-4EBP (Thr37/46) in WT and cKO naive CD4<sup>+</sup> T cells. Cells were  
1231 stimulated with or without anti-CD3/CD28 (2  $\mu$ g/ml) for 6 hours. **(J).**  
1232 Quantification of the MFI of the proteins measured in I (n = 3 mice per treatment  
1233 group). Data are representative of two independent experiments with similar  
1234 results. Phosphorylation levels were analyzed by calculating the greyscale ratios

1235 of phosphorylated proteins to their total proteins. Relative Bcl6/PP2A Ca protein  
1236 levels were normalized by greyscale ratios of Bcl6 protein to their  $\beta$ -actin  
1237 controls (Fig. S6A-F) . Data are representative of two independent experiments  
1238 and analyzed by two-sided student's t-test. Error bars of Means  $\pm$  S.D in **H**,  
1239 Means  $\pm$  SEM in **J**. \* $p$ <0.05; \*\* $p$ <0.01; \*\*\* $p$ <0.001, \*\*\*\* $p$ <0.0001.

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1240 **Supplemental Figure 7**



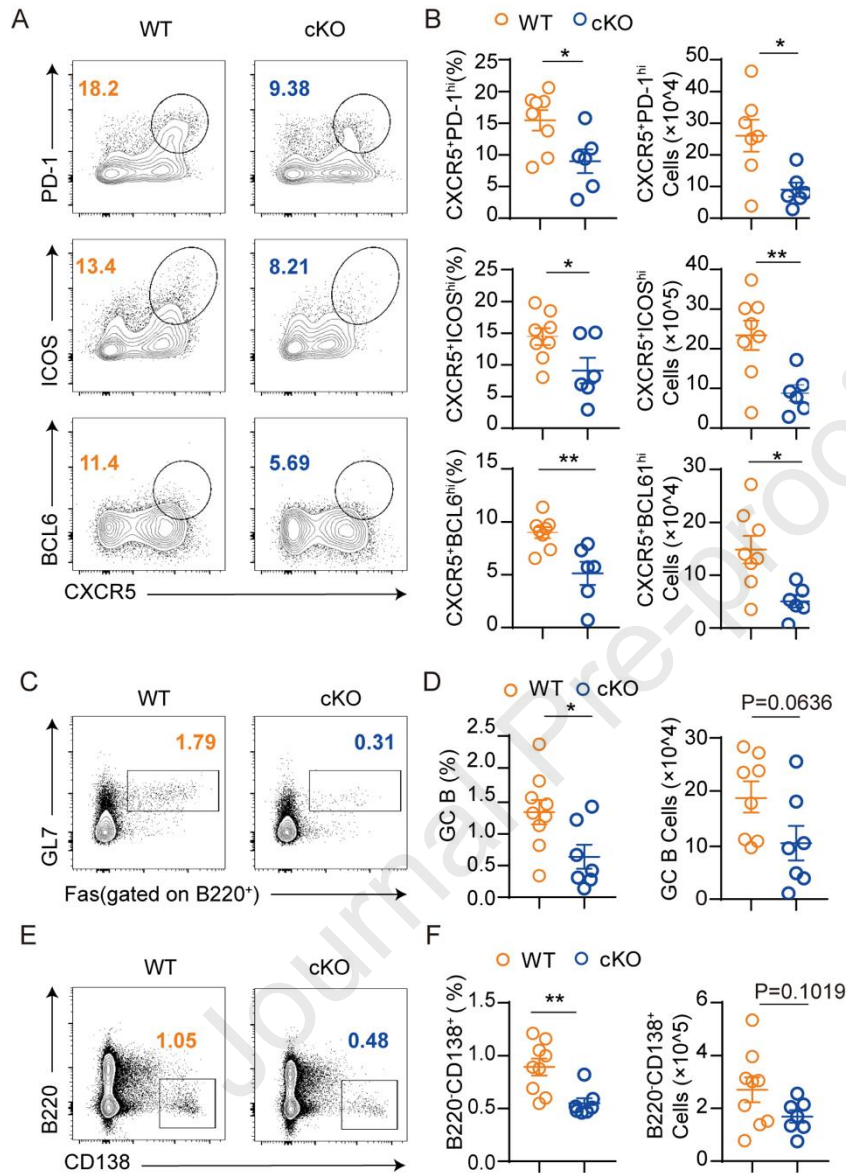
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1242 **Supplemental Figure 7. PP2A Ca deficiency protects mice from SLE**

1243 **(A-E)** Schematic diagram of experimental design. **(A)** Mice were immunized  
 1244 with chromatin in CFA and boosted twice with chromatin in IFA on day 14 and  
 1245 28 after the first immunization. Mice immunized with PBS emulsified in  
 1246 adjuvants were used as controls. The mice were analyzed on day 84 (6-8 mice  
 1247 in chromatin induced experimental group, 3 mice in PBS experimental group).

1248 **(B and C)** Anti-dsDNA and anti-histone specific antibodies in serum were  
1249 detected by ELISA. **(D)** The urine protein levels of the mice were analyzed by  
1250 BCA. **(E)** Representative PAS staining of the glomerular areas from the  
1251 kidneys. Original magnification,  $\times 40$ . Bars represent  $40\ \mu\text{m}$ . **(F)** Representative  
1252 H&E staining of the glomerular areas from the kidneys. Black arrows, infiltration  
1253 of numerous lymphocytes; red arrow, crescent. Original magnification,  $\times 40$ .  
1254 Bars represent  $40\ \mu\text{m}$ . **(G)** Immunofluorescence staining of IgG deposition in  
1255 the glomerulus was presented. Red arrow, immune complex precipitation.  
1256 Original magnification,  $\times 40$ . Bars represent  $20\ \mu\text{m}$ . Each dot represents one  
1257 individual. Data are representative of two independent experiments and  
1258 analyzed by two-sided student's t-test. Error bars of Means  $\pm$  SEM. \* $p < 0.05$ ;  
1259 \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

1260 **Supplemental Figure 8**



1261

1262 **Supplemental Figure 8. Tfh cell development is impaired in PP2A Cα**  
 1263 **deficient mice with SLE**

1264 (A) Representative flow cytometric plots of CXCR5<sup>+</sup>PD1<sup>hi</sup>, CXCR5<sup>+</sup>ICOS<sup>hi</sup>,  
 1265 CXCR5<sup>+</sup>BCL6<sup>hi</sup> Tfh in CD4<sup>+</sup>CD44<sup>+</sup> T cells for the indicated genotype. (B)  
 1266 Frequencies and cell numbers of populations in A. (C) Representative flow



1267 cytometric analysis of GL7<sup>+</sup>Fas<sup>+</sup> GC B cells from the indicated genotype. **(D)**  
1268 Frequencies and cell numbers of GC B cells in **C**. **(E)** Representative flow  
1269 cytometric plots of plasma cells (B220<sup>-</sup>CD138<sup>+</sup>) for the indicated genotype. **(F)**  
1270 Frequencies and cell numbers of plasma cells in **E**. Each dot represented one  
1271 individual. Data are representative of two independent experiments and  
1272 analyzed by two-sided student's t test. Error bars of Means  $\pm$  SEM. \* $p < 0.05$ ;  
1273 \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

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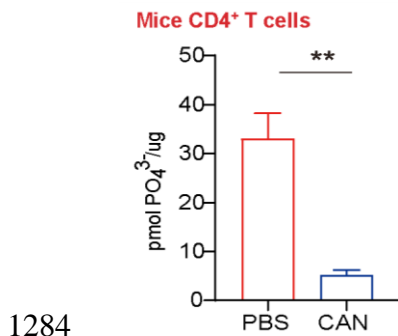
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1283 **Supplemental Figure 9**



1285 **Supplemental Figure 9. PP2A dephosphorylation activity in CD4<sup>+</sup> T cells**  
1286 **of CAN treated mice.**

1287 PP2A inhibitor CAN (0.5 mg/kg) or PBS was administered i.p. every two days  
1288 for two weeks in WT mice. PP2A dephosphorylation activity was measured in  
1289 splenic CD4<sup>+</sup> T cells. Data were analyzed by two-sided student's t test. Error  
1290 bars of Means  $\pm$  SEM. \*\*p<0.01.

1291

1292

1293 **Supplemental Table 1.** Differentially expressed genes between stimulated

1294 WT and cKO naïve CD4 T cells (attached table in excel)

	<b>logFC</b>	<b>logCPM</b>	<b>F</b>	<b>PValue</b>	<b>FDR</b>	<b>sig</b>
Pcna-ps2	2.358373573	3.176183912	293.0808048	1.49E-11	8.16E-07	down
Oasl2	1.711533414	3.440861989	227.1737872	9.82E-11	2.01E-06	down
Fos	0.65464276	9.034022517	223.6160528	1.10E-10	2.01E-06	up
Xaf1	1.141307441	5.243336106	176.5782114	6.16E-10	8.44E-06	up
Ccdc117	0.802314818	6.911182249	164.1228938	1.04E-09	1.14E-05	up
Ifit3	1.313496364	4.541657864	130.1888764	5.42E-09	4.41E-05	up
Slc15a2	3.277697505	4.911031782	257.0813123	6.11E-09	4.41E-05	up
P2ry10	0.485340338	10.35973078	125.2663004	7.10E-09	4.41E-05	down
Phf6	0.542461228	7.756959554	122.398154	8.35E-09	4.41E-05	down
Lif	0.818218928	6.65090973	121.6606923	8.71E-09	4.41E-05	up
Irf7	0.939607565	5.792605566	121.3624219	8.86E-09	4.41E-05	up
Dusp2	0.57177292	7.424229498	119.2066249	1.00E-08	4.58E-05	up
Dusp1	0.564649585	7.714138729	114.0344965	1.37E-08	5.55E-05	up
Nfkbia	0.494163323	8.666884779	110.8687556	1.66E-08	5.55E-05	up
Hbb-bs	2.016440074	4.151088713	132.015899	1.67E-08	5.55E-05	up
Hbb-bt	1.981476324	3.047206365	110.632951	1.69E-08	5.55E-05	up
Ifit3b	1.660419344	2.53904725	110.2892138	1.72E-08	5.55E-05	up
Kras	0.452172882	8.579212469	104.9220233	2.43E-08	7.39E-05	down
Ddit4	0.922107667	4.859347742	103.9845085	2.58E-08	7.45E-05	up
Crebrf	0.450775627	9.05990522	102.9279471	2.77E-08	7.59E-05	down
H2-T22	0.442321009	7.976353924	102.0484857	2.94E-08	7.66E-05	up
Gm18562	3.390406999	1.367191404	101.2011125	3.11E-08	7.74E-05	down
Icam1	0.766917765	4.89439312	99.54553554	3.48E-08	8.12E-05	up
Crbn	0.446670343	8.509928303	99.22264448	3.56E-08	8.12E-05	down
Sgk1	0.63890217	5.868607101	97.41535323	4.03E-08	8.84E-05	up
Zfp36	0.493825349	8.73416079	95.02218883	4.77E-08	9.91E-05	up
Jun	0.567243984	7.72901678	94.71258229	4.88E-08	9.91E-05	up
Tbc1d15	0.390043788	8.961284411	90.77732835	6.50E-08	0.00012725	down
Ifit1	0.895715809	4.395796705	85.51247582	9.71E-08	0.000183465	up
Gm8730	1.054058278	9.917004909	130.4717581	1.04E-07	0.000189113	up
Rras2	0.473722523	8.492302617	83.287803	1.16E-07	0.000198224	down
Hsph1	0.567262642	6.640860139	82.7563567	1.21E-07	0.00020058	up

Il7r	0.430136439	9.391770412	80.7368608	1.42E-07	0.000221762	down
Cpt1a	0.489301268	6.709289248	80.45211229	1.46E-07	0.000221762	up
Zc3h12d	0.659133899	5.758278652	79.53133189	1.57E-07	0.000232844	down
Vegfa	1.190101122	3.04891698	76.44119051	2.04E-07	0.000294378	up
Ppp2ca	0.465320926	8.701059667	74.16811433	2.49E-07	0.00034958	down
Cblb	0.558873922	8.987617473	73.34035226	2.68E-07	0.000366766	down
Smad4	0.378524936	8.095119979	72.26273606	2.95E-07	0.000387209	down
Dusp6	0.60829175	5.7985514	72.19005965	2.97E-07	0.000387209	up
Actr10	0.464690541	6.7271792	69.58966194	3.77E-07	0.000479854	down
Trim30a	0.447073193	6.710424827	66.86728054	4.87E-07	0.000606521	up
Hspa1b	1.461075215	3.558810084	66.25411838	5.54E-07	0.000654578	up
Pim1	0.408815007	8.795786318	65.53046943	5.54E-07	0.000654578	up
Arl5c	0.43615359	6.531360894	64.51713235	6.13E-07	0.000665901	up
Gadd45a	0.819724557	3.772671138	64.39654944	6.20E-07	0.000665901	up
Sln5	0.456126052	6.140468171	64.15831665	6.35E-07	0.000668719	up
Gm9625	1.060953342	7.472893739	90.82218543	6.55E-07	0.000670684	up
Usp18	0.911851002	4.02694886	63.32198694	6.90E-07	0.00068056	up
Purb	0.383897195	8.808019455	63.24139761	6.96E-07	0.00068056	down
Drc1	1.678655943	2.161683664	62.57077924	7.44E-07	0.000709646	up
Cish	0.552648884	5.078241956	62.47767248	7.51E-07	0.000709646	up
Bhlhe40	0.611464081	5.364525182	62.31182773	7.64E-07	0.000709646	up
Rnf19b	0.57873479	6.568239643	61.91993466	7.95E-07	0.000726287	up
Klf7	0.458760024	7.634055979	61.42092259	8.37E-07	0.000751921	down
Plk2	0.669505299	4.550590853	60.83513743	8.89E-07	0.000780589	up
Gadd45b	0.496067057	7.800508526	60.74724029	8.98E-07	0.000780589	up
Tmem30a	-0.448584178	7.527703521	60.56225824	9.15E-07	0.000783321	down
Pde3b	-0.406644814	9.135578013	59.67663419	1.00E-06	0.00084626	down
Tbc1d30	-0.427332429	6.822539892	59.39326522	1.03E-06	0.000858753	down
Tent5a	-0.558854054	5.31321268	57.49986096	1.27E-06	0.001021033	down
1110032F04Rik	-0.699364317	4.516434356	57.29672389	1.30E-06	0.00102871	down
Mx1	1.350692478	2.70237368	56.62369984	1.39E-06	0.001076128	up
Cmpk2	0.945682915	3.072895826	55.89791049	1.51E-06	0.001134041	up
Sit1	0.623558196	5.140644905	54.45782436	1.78E-06	0.001291133	up
Sppl2a	-0.405247375	6.348354618	54.20196038	1.83E-06	0.001291133	down
Rsad2	0.786318171	4.44091517	54.15535438	1.84E-06	0.001291133	up
Tfrc	0.461856799	6.827610514	53.88101451	1.90E-06	0.001298891	up

Ppp4r2	-0.379721031	8.028583284	53.28573539	2.03E-06	0.001373632	down
Rflnb	-0.423541517	7.789690547	52.99463474	2.10E-06	0.001403322	down
Tspan13	-0.546138195	7.326500811	52.2446493	2.29E-06	0.001487677	down
Relt	0.686693141	3.971052634	52.0766677	2.34E-06	0.001487677	up
mt-Nd6	-0.446370966	9.250958592	51.64986212	2.46E-06	0.001530517	down
Ssh2	-0.413095175	10.62227243	50.97976796	2.66E-06	0.001638746	down
Ddx58	0.466547408	6.680883798	50.56320297	2.80E-06	0.001703474	up
Lrig1	-0.408322838	7.819380555	50.274683	2.90E-06	0.001744343	down
Ccrl2	1.352626217	2.111572662	49.20887782	3.30E-06	0.001956598	up
Fli1	-0.488691427	7.531837055	49.1534375	3.32E-06	0.001956598	down
Twsg1	-0.387614856	6.87321406	48.91233689	3.42E-06	0.001973111	down
H2-T23	0.418515477	7.240032292	48.62350483	3.55E-06	0.002023539	up
lfi203	0.442971883	7.361284427	48.44900241	3.62E-06	0.002046514	up
Cd86	0.809240221	3.136653947	48.31683367	3.68E-06	0.002059208	up
H2-T24	0.734444664	4.339942117	48.16214434	3.76E-06	0.002078101	up
Errfi1	0.517420259	5.4377037	46.66358665	4.54E-06	0.002392788	up
Mx2	1.252293236	2.552061374	46.50756139	4.63E-06	0.002392788	up
Adam19	0.893904364	4.595191488	46.26235553	4.78E-06	0.002446296	up
Arrb2	0.514072973	5.935713774	45.75679367	5.10E-06	0.002573745	up
Cry1	-0.427047778	6.473004158	45.67752591	5.15E-06	0.002573745	down
Mov10	0.531661325	4.97583142	44.46651609	6.04E-06	0.002888527	up
Amn1	-1.157096619	3.279891076	43.99408624	6.43E-06	0.003038807	down
Zbp1	0.940867043	5.756446919	53.17361849	6.60E-06	0.003077532	up
Ctsw	0.794729251	4.130186906	43.7720508	6.63E-06	0.003077532	up
Arc	0.750208478	3.840134905	43.07315964	7.28E-06	0.003312047	up
Tagap1	0.470653025	6.397739902	42.41564751	7.97E-06	0.003493132	up
Rock1	-0.392718213	8.759085538	42.01268239	8.43E-06	0.003629488	down
Ighm	0.451209	7.099426827	41.97496753	8.47E-06	0.003629488	up
Rasgef1b	0.788492272	3.245884541	41.9366926	8.51E-06	0.003629488	up
Gm9522	2.201187397	0.885563479	41.9103279	8.55E-06	0.003629488	up
Hspa4l	-0.456048383	6.920530791	41.61093126	8.91E-06	0.003717854	down
Psme2	0.497138467	6.091755364	41.57225419	8.96E-06	0.003717854	up
Zbtb7b	0.627795075	4.808251821	41.18668238	9.45E-06	0.003865584	up
E2f2	0.962397412	2.673049202	40.90756155	9.83E-06	0.003938552	up
Ly6c2	1.438947102	2.684635875	40.86061645	9.90E-06	0.003938552	up
Pim3	0.471248441	5.780827479	40.79437718	9.99E-06	0.003938552	up

Cpsf2	-0.433644886	6.104592076	40.60554638	1.03E-05	0.004016538	down
Fam8a1	-0.396785089	6.103420323	40.44887706	1.05E-05	0.004077925	down
Aes	0.379600655	6.931832632	39.7633538	1.16E-05	0.004374906	up
Prr3	0.55993579	4.331727488	39.66567506	1.17E-05	0.004406656	up
Nubp2	0.630429289	4.933029728	39.2789588	1.24E-05	0.004582821	up
Hdac7	0.402806467	6.226486602	39.19598832	1.26E-05	0.004591772	up
Ell2	-0.489695927	5.49281464	38.67687914	1.36E-05	0.004873618	down
Ly9	0.469322583	7.065512777	37.70881815	1.57E-05	0.005363591	up
Ubl4a	-0.548723166	4.600156934	37.31606359	1.66E-05	0.005654963	down
Trim13	-0.527521917	4.923563154	37.22006786	1.69E-05	0.005702261	down
Klhl28	-0.383913253	6.490443935	36.98911939	1.75E-05	0.00583363	down
Rtn4r1	0.635626398	3.557727929	36.93361682	1.76E-05	0.005847456	up
lfi206	0.385119595	6.379984484	36.52549137	1.87E-05	0.006186415	up
lsg20	0.735078484	3.819189111	36.24969218	1.96E-05	0.006338369	up
lfi27l2a	0.692665949	6.738185944	42.05803101	1.97E-05	0.006338369	up
Arhgef2	0.540979497	5.458774367	36.06433758	2.01E-05	0.006373563	up
Dusp4	0.506142	4.79697031	35.77583235	2.10E-05	0.006589538	up
P2rx7	0.972659316	3.303824748	35.7349874	2.12E-05	0.006593942	up
Gcn11	0.465997627	6.926711411	35.62099409	2.16E-05	0.006658128	up
Utp14b	-0.445402024	6.979021645	35.36662614	2.24E-05	0.006830031	down
Arhgap5	-0.551866782	4.948041227	35.06681346	2.35E-05	0.007120868	down
Rnf213	0.774871431	9.461096477	50.62011904	2.40E-05	0.007225642	up
Abcb1a	-0.578711494	4.821452154	34.51218904	2.57E-05	0.007576085	down
Arap2	-0.463913986	8.684467329	35.69434474	2.59E-05	0.007576085	down
Nabp2	0.71022013	3.655452913	34.31581629	2.65E-05	0.007685921	up
Trem12	0.390102395	6.436418249	34.27050212	2.67E-05	0.007701304	up
Dhx58	0.630463533	3.95384658	34.18675429	2.71E-05	0.007747225	up
AC102496	-0.974873693	2.400859761	33.7967946	2.88E-05	0.008100234	down
Camsap2	-0.411473229	7.592401414	33.6625398	2.95E-05	0.008236626	down
mt-Te	-0.575325385	3.977654969	33.29873072	3.13E-05	0.008652586	down
Sesn2	0.52556892	4.586892136	33.25240779	3.15E-05	0.008674772	up
Cd52	0.455494351	7.845368414	32.88345132	3.38E-05	0.009068898	up
Ctsd	0.389964369	7.579894318	32.76604059	3.41E-05	0.009124362	up
Gm19951	1.70038555	0.387377692	32.64083914	3.49E-05	0.009270811	up
H2-T10	0.496331386	6.495157418	32.4710569	3.59E-05	0.00949067	up
Gata3	0.478438662	5.460632684	31.93129084	3.93E-05	0.010139493	up

2310043P16Rik	-0.469511323	4.845183681	31.45209376	4.26E-05	0.010749903	down
Phlda1	0.632893386	3.668640729	31.39933915	4.30E-05	0.010749903	up
Gm6485	0.573763936	4.293008658	31.29123491	4.38E-05	0.010878326	up
Prf1	-0.526470288	4.698526994	31.14873343	4.49E-05	0.011020132	down
Cd96	0.391531183	6.772226943	30.91351802	4.67E-05	0.011336563	up
Hspa1a	1.193041431	2.274212545	30.61463142	4.92E-05	0.011740692	up
lfih1	0.515962615	5.459553149	30.50430397	5.01E-05	0.011743092	up
Rplp0	-0.508959036	11.18718039	38.09514085	5.02E-05	0.011743092	down
Oas2	1.328110332	4.867872009	42.64900187	5.30E-05	0.012156876	up
Herc6	0.518994518	5.232969799	29.95960479	5.52E-05	0.012438951	up
lsg15	0.658298546	3.789460432	29.89187457	5.58E-05	0.012485831	up
Lgals9	0.385774916	6.902601492	29.84594526	5.63E-05	0.012536458	up
Ccdc69	0.652323118	3.286303019	29.72408455	5.75E-05	0.012605041	up
Jaml	0.658478398	3.589311119	29.6440082	5.83E-05	0.012734586	up
Kansl2	0.435694039	5.475771978	29.34291137	6.16E-05	0.013337206	up
Ttbk2	-0.913148339	3.731807679	29.30114609	6.27E-05	0.013526229	down
Cd48	0.44851169	4.674791057	29.17414991	6.35E-05	0.013632553	up
Wdr89	0.428529393	6.895519525	28.93981633	6.62E-05	0.014157199	up
Kctd12b	-0.499241294	4.115733996	28.92119734	6.64E-05	0.014157199	down
Zfp973	-6.515598752	-1.596454352	31.78451598	6.73E-05	0.014296421	down
Prr7	0.743961026	3.337556982	28.71034269	6.90E-05	0.014538706	up
Ddx60	0.534675343	5.663811698	28.54437534	7.11E-05	0.014870066	up
2410006H16Rik	0.37977745	6.106845553	28.45068704	7.23E-05	0.015011926	up
C2cd3	0.405906584	6.371630184	28.3216807	7.41E-05	0.015312533	up
Gem	0.512804948	4.3137518	27.95662517	7.92E-05	0.016193518	up
Rilpl2	0.396002582	5.114442313	27.9037467	8.00E-05	0.016291911	up
Ap3s1	-0.382172121	5.69045758	27.86745182	8.05E-05	0.016341038	down
Gm14165	0.865408177	2.545814444	27.78136676	8.18E-05	0.016481936	up
Mast3	0.428530035	5.867573094	27.69174578	8.32E-05	0.016697378	up
Atxn3	-0.411329824	5.786749521	27.58951123	8.48E-05	0.01695631	down
Nrros	0.512213756	4.734398958	27.52570131	8.58E-05	0.017035134	up
Oas3	0.507713815	4.008594938	27.12963445	9.24E-05	0.018217824	up
Ptpn6	0.457219967	6.022786992	27.07429737	9.34E-05	0.0182643	up
Rasal3	0.402073523	7.565205663	27.06576139	9.36E-05	0.0182643	up
Dapl1	0.524117983	4.421822588	26.85573294	9.74E-05	0.018813708	up
Vcpkmt	0.706864601	2.812735403	26.48601139	0.000104473	0.019943384	up

Lmna	0.524305757	4.37105626	26.25209662	0.000109276	0.020716021	up
Batf	0.449519693	4.78738485	26.2285543	0.000109774	0.020738504	up
Lman2l	0.64234687	3.636200256	26.06554042	0.000113287	0.021255631	up
Ms4a4c	0.63790769	4.052022302	25.88096782	0.000117419	0.021806875	up
Polr2g	0.415742503	4.589478869	25.81678615	0.000118895	0.022006498	up
Pura	-0.400319688	5.612313093	25.67505769	0.000122231	0.022471939	down
Tbk1	-0.409456422	6.482006807	25.62389042	0.000123461	0.022471939	down
Mki67	0.776092868	3.379251059	25.57307813	0.000124696	0.022621642	up
4933412E12Rik	1.041501288	2.059177464	25.46060294	0.000127481	0.022974645	up
Eif2ak2	0.537059446	4.362254724	25.38103989	0.000129493	0.023260763	up
Hba-a1	1.856226626	3.980806417	37.73597221	0.00013408	0.023772951	up
Gpat3	-0.514951399	3.568604757	25.16572512	0.000135121	0.023880188	down
App	-0.509252807	4.430205837	25.05224592	0.000138198	0.024345441	down
Adprhl2	0.66531778	4.505485684	24.79993261	0.000145327	0.02537625	up
BC147527	0.91718032	2.366649007	24.79608721	0.000145439	0.02537625	up
Fam241a	-0.456644345	4.583561478	24.73384277	0.000147262	0.025612865	down
Bcl9l	0.404570807	5.699207766	24.27655523	0.00016148	0.027526669	up
Ccpg1	0.425228913	6.07451144	24.23749293	0.000162765	0.027526669	up
Ndfip1	-0.402554193	7.271413869	24.22550688	0.000163161	0.027526669	down
Tspan32	0.527256263	5.093379963	24.1238132	0.00016657	0.027907864	up
Bmf	0.762279437	2.705219878	24.06512298	0.000168574	0.028157474	up
Pwwp2b	0.858400959	1.957914161	23.97532301	0.000171693	0.028504613	up
Trav14d-3-dv8	0.457268626	3.760585294	23.90308491	0.000174249	0.028660574	up
Zgpat	0.496972737	5.320272861	23.7433343	0.000180056	0.029134618	up
Ly6c1	0.494667978	5.734828323	23.73746988	0.000180273	0.029134618	up
Abi3	0.70383888	2.765512397	23.43875836	0.000191744	0.030664732	up
Pex26	0.948195256	2.843029305	23.18122453	0.000202299	0.032219071	up
Bst2	0.472044031	5.143463518	23.16136563	0.00020314	0.032259203	up
Ifi44	1.003910683	1.860544616	22.94361607	0.000212623	0.033378129	up
Trim30d	0.558174323	4.491149108	22.64131872	0.000226629	0.034779564	up
Tigit	-0.473738239	4.476319039	22.45595385	0.000235732	0.03570398	down
Rbm4	0.405912592	4.818467919	22.14655038	0.000251862	0.037496588	up
Hexa	0.397523509	4.520322178	22.12908507	0.000252809	0.037535585	up
Gm7993	0.536403473	3.911793914	22.08548345	0.000255191	0.037684985	up
Sh2d3c	0.442968785	4.618186076	22.03970535	0.000257719	0.037717895	up
Lbp	1.12262062	0.894663614	22.0316377	0.000258167	0.037717895	up



Sema4b	0.473355648	4.03216719	21.94745217	0.0002629	0.038205593	up
Coro2a	0.794775694	2.361332712	21.91757317	0.000264603	0.038294599	up
Phf11b	0.44862339	4.354933656	21.898891	0.000265675	0.038304006	up
Gramd1a	0.769858619	8.048232607	30.52544435	0.00027518	0.039267789	up
Oas1a	0.627301927	3.302747323	21.73600013	0.000275226	0.039267789	up
Parp10	0.423040309	5.429251044	21.71161293	0.00027669	0.03937401	up
Arhgap26	0.555328726	3.603080637	21.57300692	0.000285175	0.040301815	up
Emp3	0.423502661	4.776822767	21.18079032	0.000310823	0.042466505	up
Camta2	0.382517664	4.596697354	21.13169246	0.000314214	0.042716699	up
mt-Tl1	0.480374695	3.585138769	21.08853836	0.000317228	0.042807872	down
Emp1	0.851300172	2.741046267	21.05438187	0.000319638	0.042893957	down
Cln3	0.706927303	3.222071074	21.04110852	0.00032058	0.042893957	up
Fam83d	0.671130151	3.148375202	21.03522565	0.000320998	0.042893957	up
Smim10l1	0.439208565	4.35947545	21.01498897	0.000322442	0.042982097	down
Gadl1	7.276231174	2.689778348	22.62989854	0.000327963	0.043506337	up
Csrnp2	0.444193877	4.955698613	20.85998609	0.00033375	0.044167108	up
D2hgdh	0.47795263	3.728810603	20.82255068	0.000336548	0.044323245	up
Tap1	0.46608729	7.019559384	22.47424276	0.000341185	0.044554412	up
Pigw	-0.731868808	3.04457625	20.74848203	0.000342163	0.044554412	down
Nfkbie	0.57025561	5.486258702	21.38732535	0.000390355	0.049277326	up
Gm26885	0.482965576	4.191308734	20.12185731	0.000394139	0.049640633	up
Rnf157	0.543403126	4.146726113	20.08989228	0.00039702	0.049661069	up

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1297 **Supplemental Table 2.** Participants of patients with SLE and their healthy

1298 controls (attached table in excel)

Sample ID	Age (years)	Sex	Ethnicity	Glucocorticoid does (PDN, median ranges, mg/day)	MTX	HCQ	AZA	MMF	CsA	CTX	SLED AI score (median ranges)	ANA
Patient 1	48	F	Asian	/	no	no	no	no	no	no	0	yes
Patient 2	28	F	Asian	10mg/d	no	no	no	no	no	no	0	yes
Patient 3	63	F	Asian	7.5mg/d	no	no	yes	no	no	no	1	yes
Patient 4	52	F	Asian	5mg/d	no	yes	no	no	no	no	4	yes
Patient 5	45	F	Asian	2.5mg/d	no	yes	no	no	no	no	0	yes
Patient 6	24	F	Asian	5mg/d	no	yes	no	no	no	no	0	yes
Patient 7	43	F	Asian	5mg/d	yes	yes	no	no	no	no	2	yes
Patient 8	36	F	Asian	7.5mg/d	yes	yes	no	no	no	no	3	yes
Patient 9	37	F	Asian	12.5mg/d	no	yes	yes	no	no	no	4	yes
Patient 10	49	F	Asian	3.75mg/d	no	yes	no	yes	no	no	0	yes
Control 1	44	F	Asian									
Control 2	28	F	Asian									
Control 3	68	F	Asian									
Control 4	51	F	Asian									
Control 5	45	F	Asian									
Control 6	24	F	Asian									
Control 7	42	F	Asian									
Control 8	38	F	Asian									
Control 9	35	F	Asian									
Control 10	44	F	Asian									

Drug history recorded the information in the past 1 month.

F: female; PDN: prednisone; MTX: methotrexate; HCQ: hydroxychloroquine; AZA: azathioprine; CsA: cyclosporin; MMF: mycophenolate mofetil; CTX: cyclophosphamide; CNS: central nervous system; ANA: antinuclear antibody

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