Supplementary Figure Legends

Supplementary Figure 1. High frequencies of circulating B cells in patients with CLL. Frequencies of T and B cells in patients with CLL and HDs (A) (patients with CLL n=12, HDs n=9). Representative flow cytometric analysis of CD5+ B cells in patients with CLL, identified in the lymphocyte and blasts cells gates (B).

Supplementary Figure 2. *In vitro* expanded CD19 CAR T cells from patient with CLL kill specifically CD19+ cells. (A) Frequencies of CD3+ T cells and CD19+ B cells three days after CD19 CAR retroviral transduction of a patient with CLL cells (top panel), and in untransduced control cells (bottom panel). (B) CD19 CAR T cells produced from a patient with CLL were incubated for 24hrs with either CD19+ K562 cells (top panel), or NGFR+ K562 cells (bottom panel) before analysis.

Supplementary Figure 3. CD4/CD8 ratio of *in vitro* expanded CD19 CAR+ and CAR- T cells. CD4/CD8 ratio in CD19 CAR+ and CD19 CAR- T cells in patients with CLL (n=9) and healthy donors (n=9). Wilcoxon test.

Supplementary Figure 4. *In vitro* expanded CD19 CAR- T cells phenotype. CD45RA and CCR7 expression in (A) patients with CLL (n=9), and (B) in HDs (n=9). Squares represent CD8+ CD19 CAR- T cells, and triangles CD4+ CD19 CAR- T cells. Wilcoxon test, * $P < 0.05$. ** $P < 0.004$.

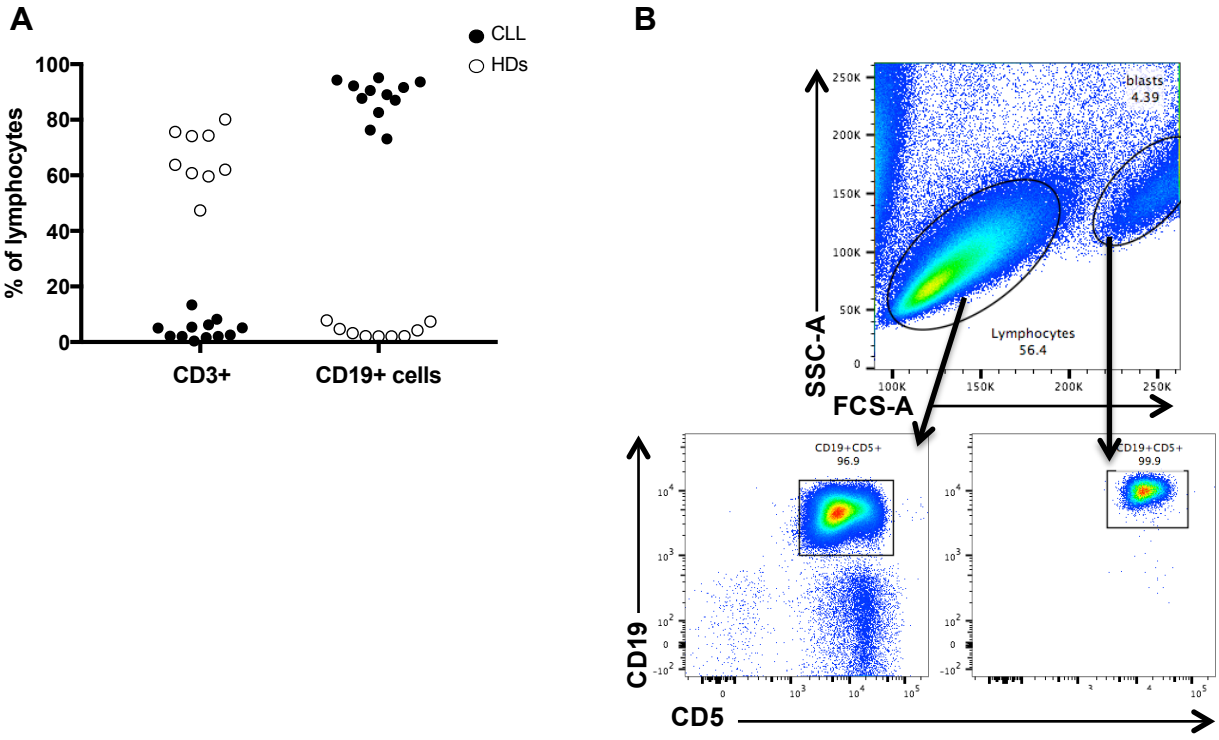
Supplementary Figure 5. Cytokine production in response to NGFR+ K562 cells, and after PMA/Ionomycin stimulation of *in vitro* expanded CD19 CAR transduced T cells. Frequencies within (A) CD8+ and (B) CD4+ T cells after stimulation with NGFR+ K562 cells in patients with CLL (n=9) and HDs (n=7), and after PMA/Ionomycin stimulation within (C) CD8+ T cells and (D) CD4+ T cells in

patients with CLL (n=7) and HDs (n=5). Black circles represent patients with CLL, and open circles HDs. Mann-Withney test, * $P < 0.04$. ** $P < 0.006$.

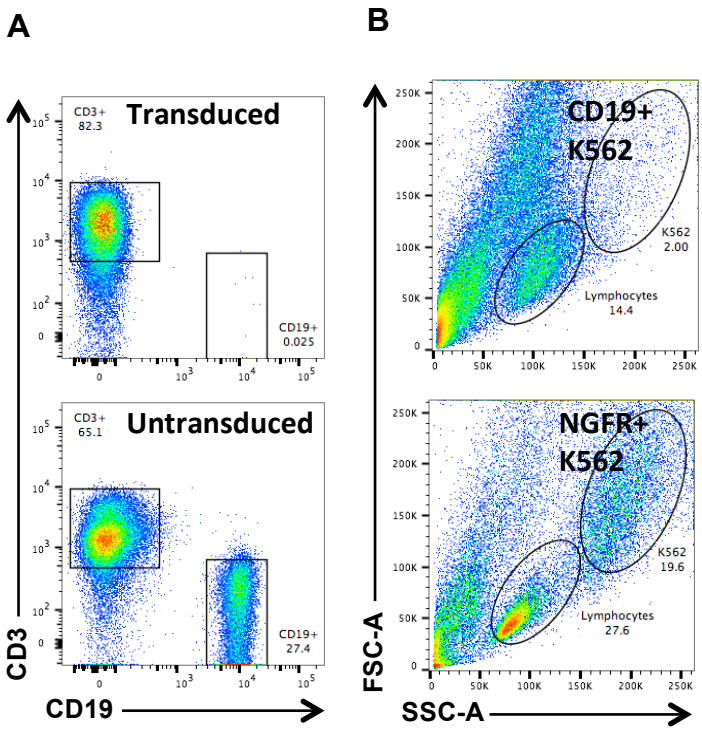
Supplementary Figure 6. CD19+ K562 cells express high levels of cell surface CD19. Overlay of CD19 cell surface expression from CD19+ K562 cells, CLL cells and HD (EBV-transformed) B cells using a FITC-conjugated CD19 antibody (A), from CLL cells (n=4) and HD (EBV-transformed) B cells (n=3) using an APC-conjugated CD19 antibody (B).

Supplementary Figure 7. CD19+ K562 and autologous B cells induce a different effector profile on *in vitro* expanded and stimulated CD19 CAR T cells. The different combinations of CD107a expression and IFN-γ/IL-2/TNF production median values within activated (displaying at least one of the function measured) CD8+ and CD4+ CD19 CAR T cells in response to either CD19+ K562 cells or autologous B cells (A and B) in patients with CLL (n=9), and (C and D) in HDs (n=7-8). Mann-Whitney test, * $P < 0.05$. ** $P < 0.008$.

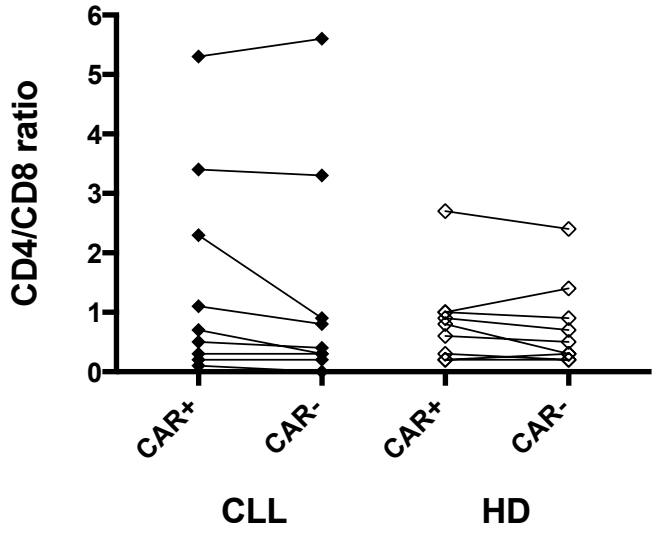
Supplementary Figure 1.



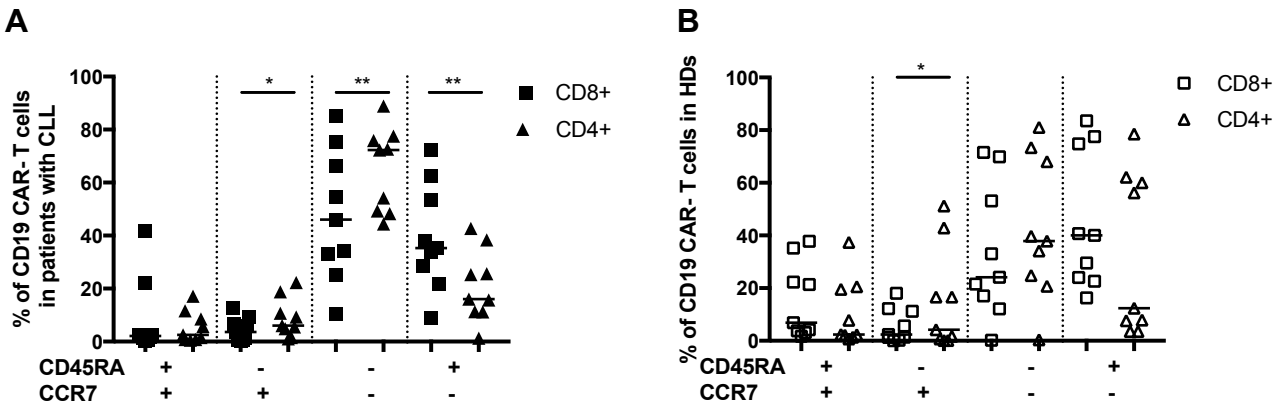
Supplementary Figure 2.



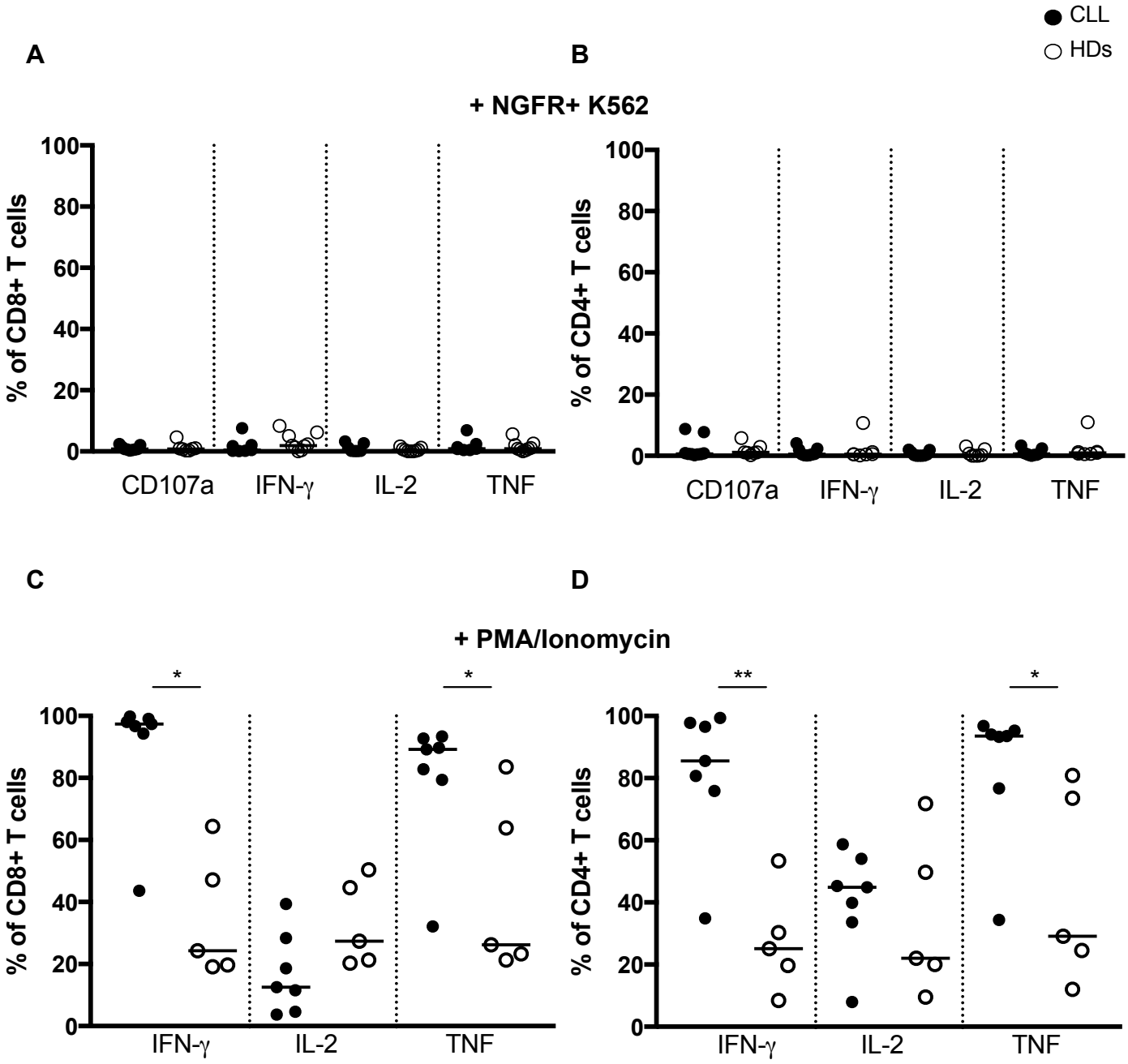
Supplementary Figure 3.



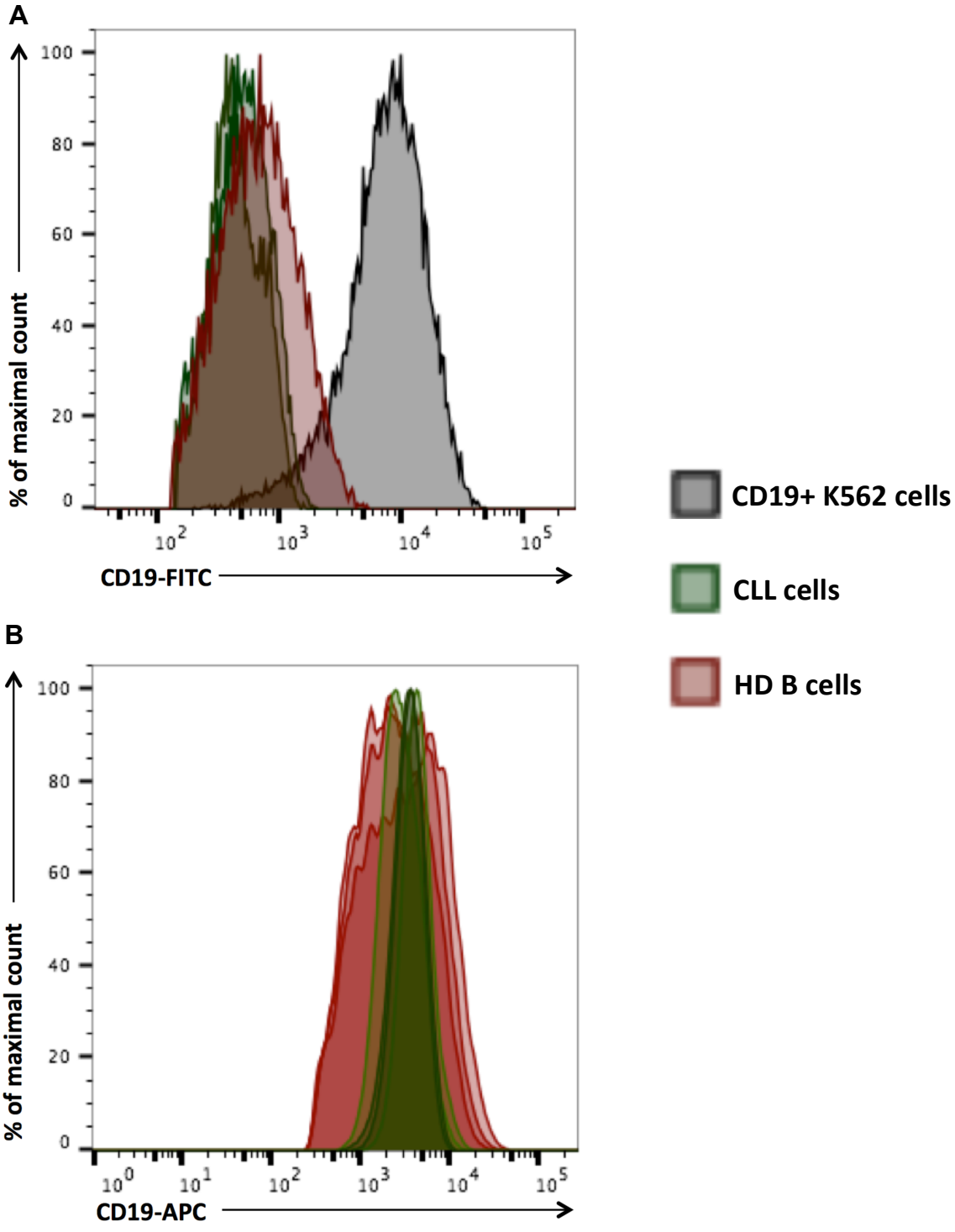
Supplementary Figure 4.



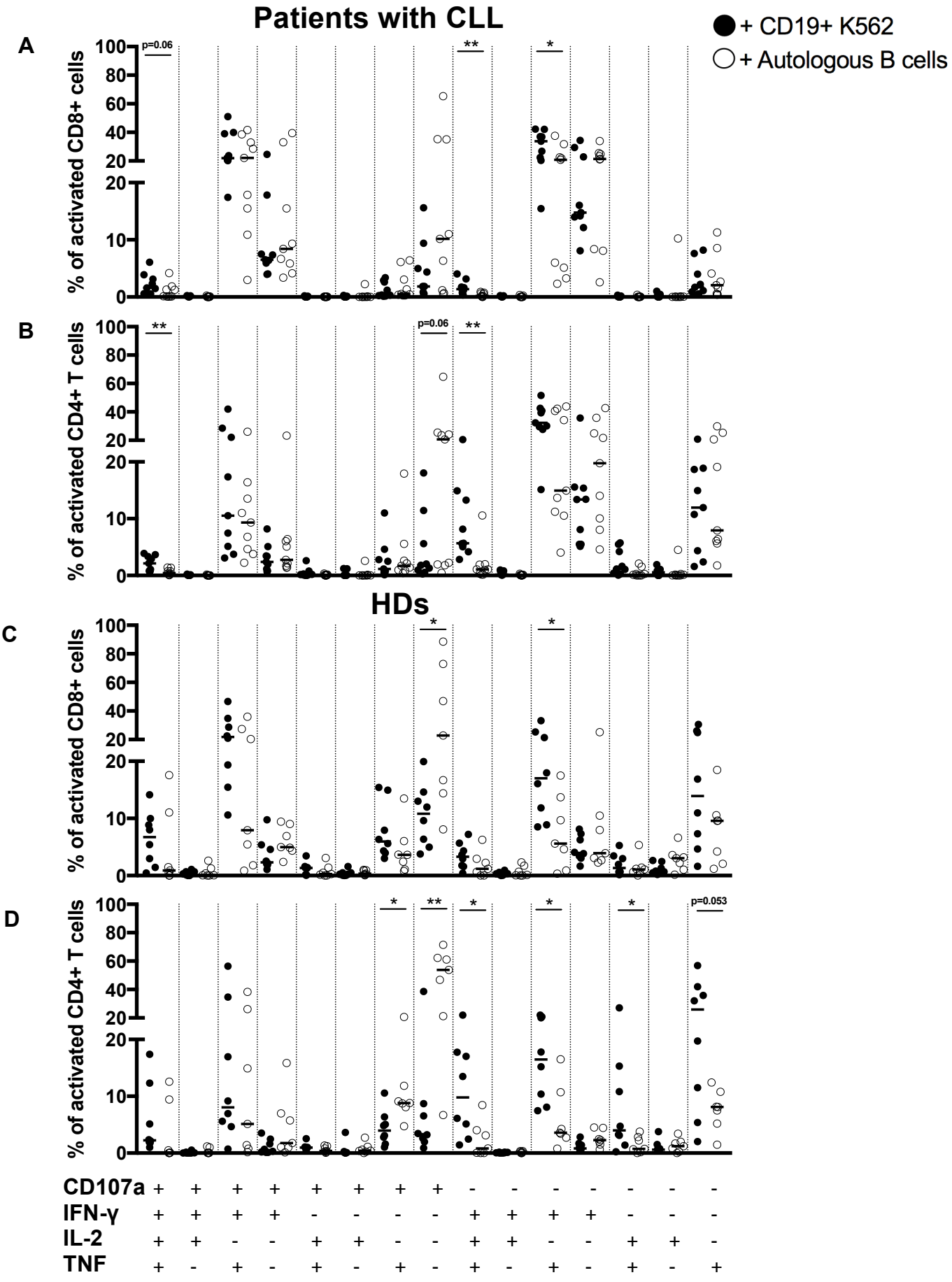
Supplementary Figure 5.



Supplementary Figure 6.



Supplementary Figure 7.



Supplementary Table 1. Characteritics of patients with CLL

Patient	WBC (10^9/L)	Lypmphocytes (10^9/L)	Rai stage *	FISH	Clinical phase**	Previous therapy	Ongoing therapy	Response to last therapy
#01	27.2	23	-	13q-	Stable PR after therapy	Yes, FC (2010)	No	PR
#02	170	167	3	ND	Progressive disease	No	No	-
#03	56	51.2	4	11q-	Progressive disease	Yes, FC (2008)	No	PR
#04	23	19.3	1	ND	Indolent		No	-
#05	287.6	279.2	3	Normal	Progressive disease	No	No	-
#06	106.9	105.9	3	ND	Indolent	No	No	-
#07	281.3	280.5	4	13q-	Progressive disease	No	No	-
#08	102.9	97.8	3	13q-	Progressive disease	No	No	-
#09	62.7	60.5	0	ND	Indolent	No	No	-
#10	161.2	160.7	4	13q-	Progressive disease	No	No	-
#11	121.8	118	1	17q-	Progressive disease	No	No	-
#12	157.5	154.2	2	13q-	Indolent	No	No	-

WBC= whole blood count, PR= partial response, FC= fludarabine cyclophosphamide, ND= not determined, (-)= not applicable. * For untreated patients only. ** At time of blood collection.