

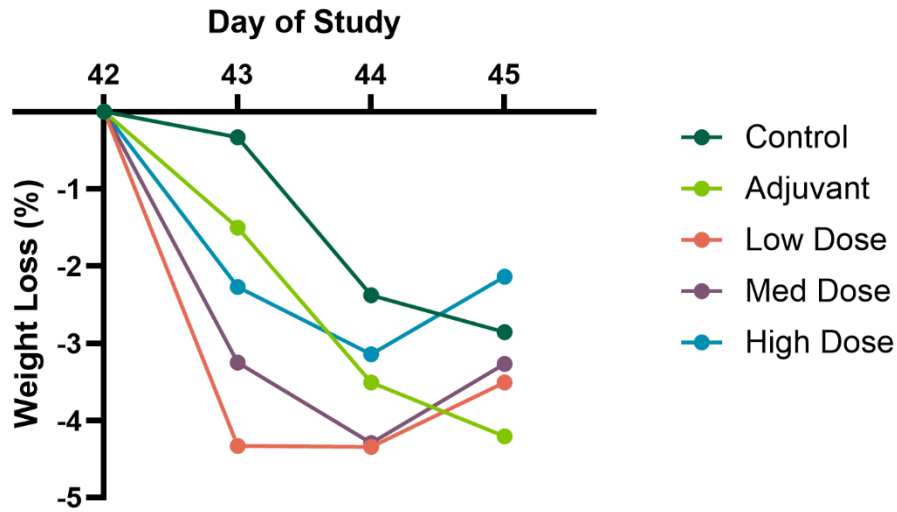


Figure S1. Weight loss following infection challenge. Weight loss is represented as a percentage of the weight measured immediately prior to the infection challenge on Day 42. On the day after challenge on average all animals in the vaccine groups lost a greater percentage of body weight than either of the control groups, but the rate of weight loss slowed after 2 days and began to recover by the third day. Animals in the two control groups lost weight steadily until the day of euthanasia. By euthanasia the High Dose group had the lowest net weight loss while the Adjuvant-only group had the highest. Differences among groups did not reach statistical significance.

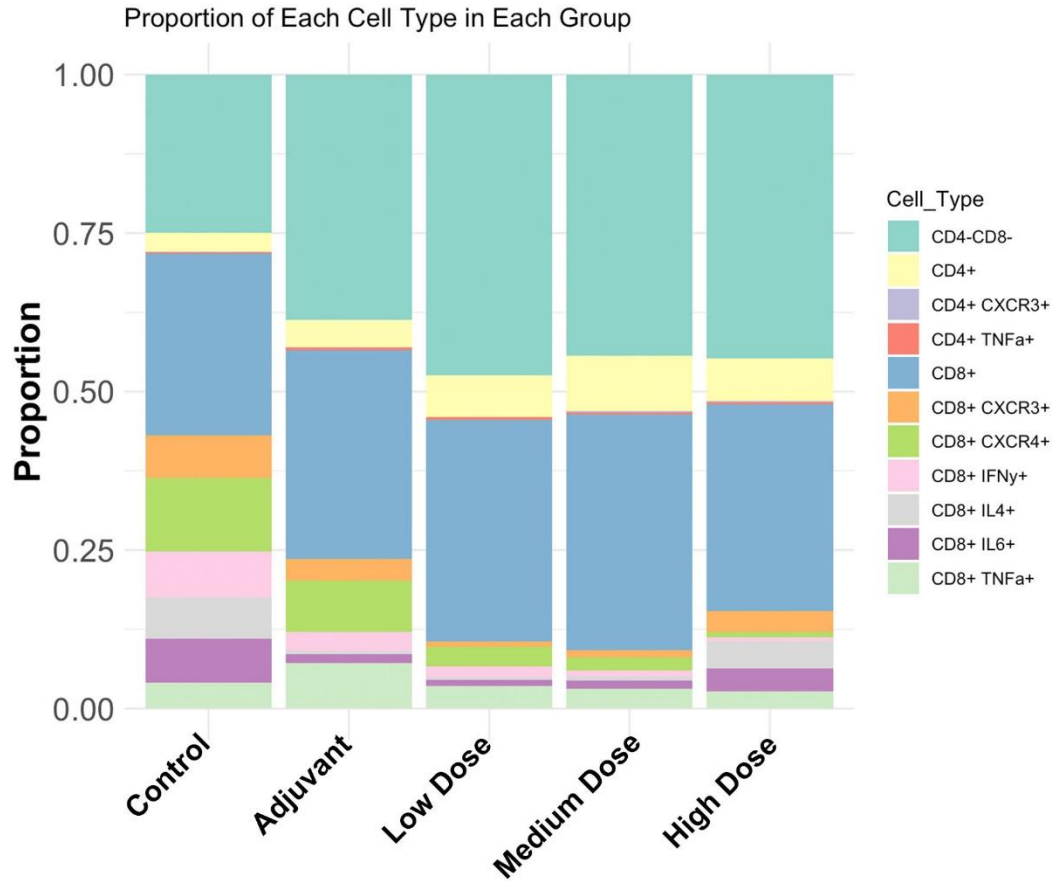


Figure S2. We quantified the relative abundance (ratio) of each lung immune cell population across experimental groups. Lung cells were harvested, stained for T-cell surface markers and intracellular cytokines, and acquired on a Cytex Aurora spectral flow cytometer. Data were analyzed in FlowJo. For each sample, population ratios were calculated by dividing the number of events in each gated population by the total lung cell count, and values were plotted as ratios (normalized to 1). Control (and to a lesser extent adjuvant-only) animals showed a larger contribution of activated/inflammatory CD8 compartments (CXCR4⁺ and IL-6⁺ fractions), whereas vaccinated groups displayed relatively reduced inflammatory CD8 contributions alongside a greater representation of non CD4/CD8 (“CD4–CD8–”) and CD4⁺ compartments.

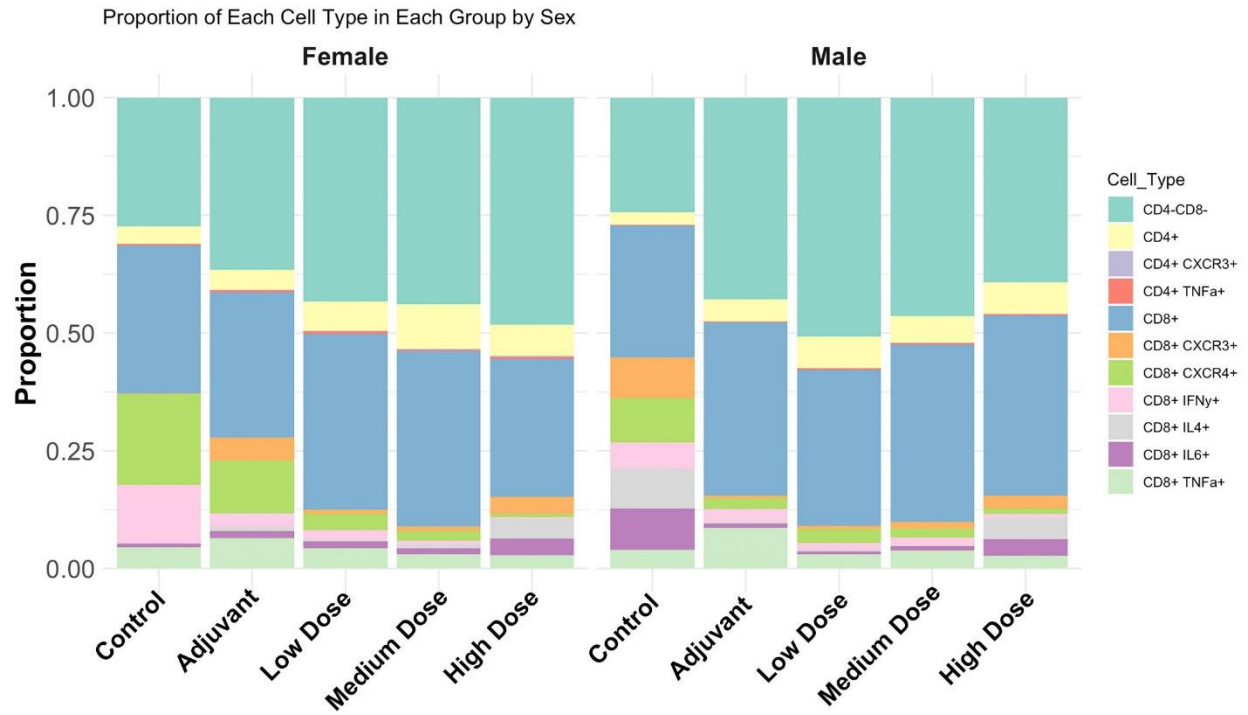


Figure S3. Sex-stratified compositional summary of cell types. Compositional patterns were broadly conserved in both females and males, indicating that the directional vaccine-associated remodeling was not driven by a single sex.

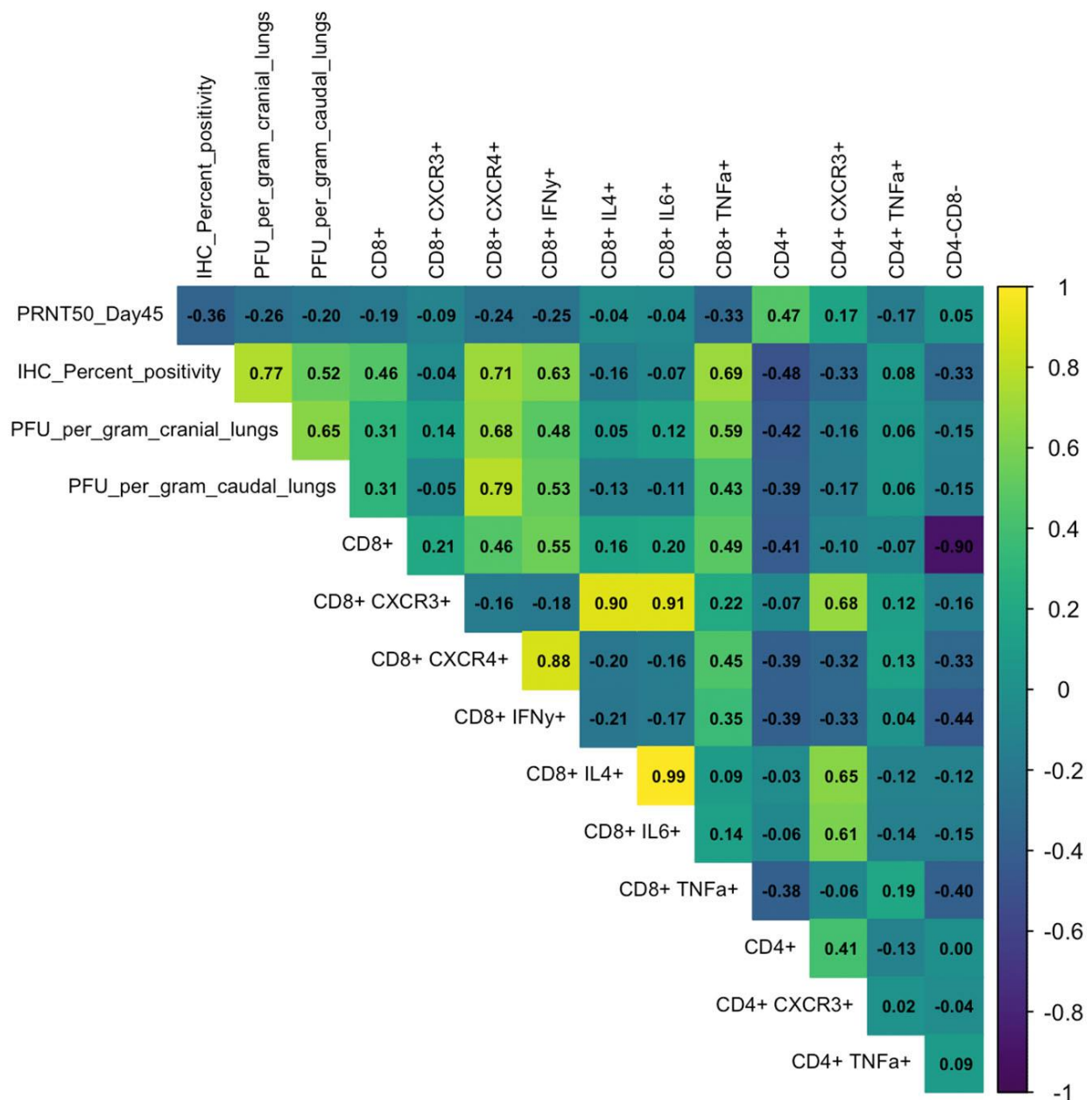


Figure S4. Correlation heatmap of neutralizing antibody titers, viral burden, lung pathology, and T-cell responses. Heatmap shows pairwise correlation coefficients (r) across individual animals between PRNT₅₀ at Day 45, lung immunohistochemistry percent positivity, viral load (PFU/g) measured separately in cranial and caudal lung lobes, and the frequencies of the indicated lung T-cell populations quantified by spectral flow cytometry. Numbers within tiles denote r values, and color indicates the direction and magnitude of the correlation (scale -1 to +1; purple = negative, yellow = positive). Correlation test used: Spearman Correlation analysis.

Antibody	Clone	fluorophore	Concentration of antibody used	Company	Catalogue	References
CD4	GK1.5	Pacific blue	1 µg/ml	Biolegend	100428	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3196444/
CD8	341	FITC	2 µg/ml	BD Biosciences	554973	https://onlinelibrary.wiley.com/doi/full/10.1111/imm.12116 https://www.ncbi.nlm.nih.gov/pubmed/24722669
IFN-γ	XMG1.2	BV785	1 µg/ml	Biolegend	505838	https://onlinelibrary.wiley.com/doi/epdf/10.1111/pim.12358
IL-10	JES5-16E3	BV421	1 µg/ml	Biolegend	505022	https://onlinelibrary.wiley.com/doi/epdf/10.1111/pim.12358
Gata-3	16E10A23	PE	0.5 µg/ml	Biolegend	653804	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5223125/
Tbet	4B10	BV711	0.5 µg/ml	Biolegend	644820	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5223125/
IL-4	11-B11	APC	1 µg/ml	Biolegend	504106	https://onlinelibrary.wiley.com/doi/epdf/10.1111/pim.12358
TNFα	MP6-XT22	PE-Dazzle 594	0.5 µg/ml	Biolegend	506346	Based on percent similarity of protein sequence, hamster and mouse: 82%
IL-6	MP5-20F3	Percp efluor 710	1 µg/ml	Thermo Scientific	46-7061-82	Based on percent similarity of protein sequence, hamster and mouse: 73%
CXCR3	173	APC-Fire 750	1 µg/ml	Biolegend	126540	Based on percent similarity of protein sequence, hamster and mouse: 91.1%
CXCR4	2B11	BV650	2 µg/ml	BD Biosciences	740526	Based on percent similarity of protein sequence, hamster and mouse: 82%
Zombie NIR		Live/dead	1:2000 dilution	Biolegend	423106	Based on percent similarity of protein sequence, hamster and mouse: 93.2%

Figure S5. Antibody details. Details of the clones, suppliers, catalog numbers and origin of the antibodies used for flow cytometry analysis of immune cells in Syrian hamsters.

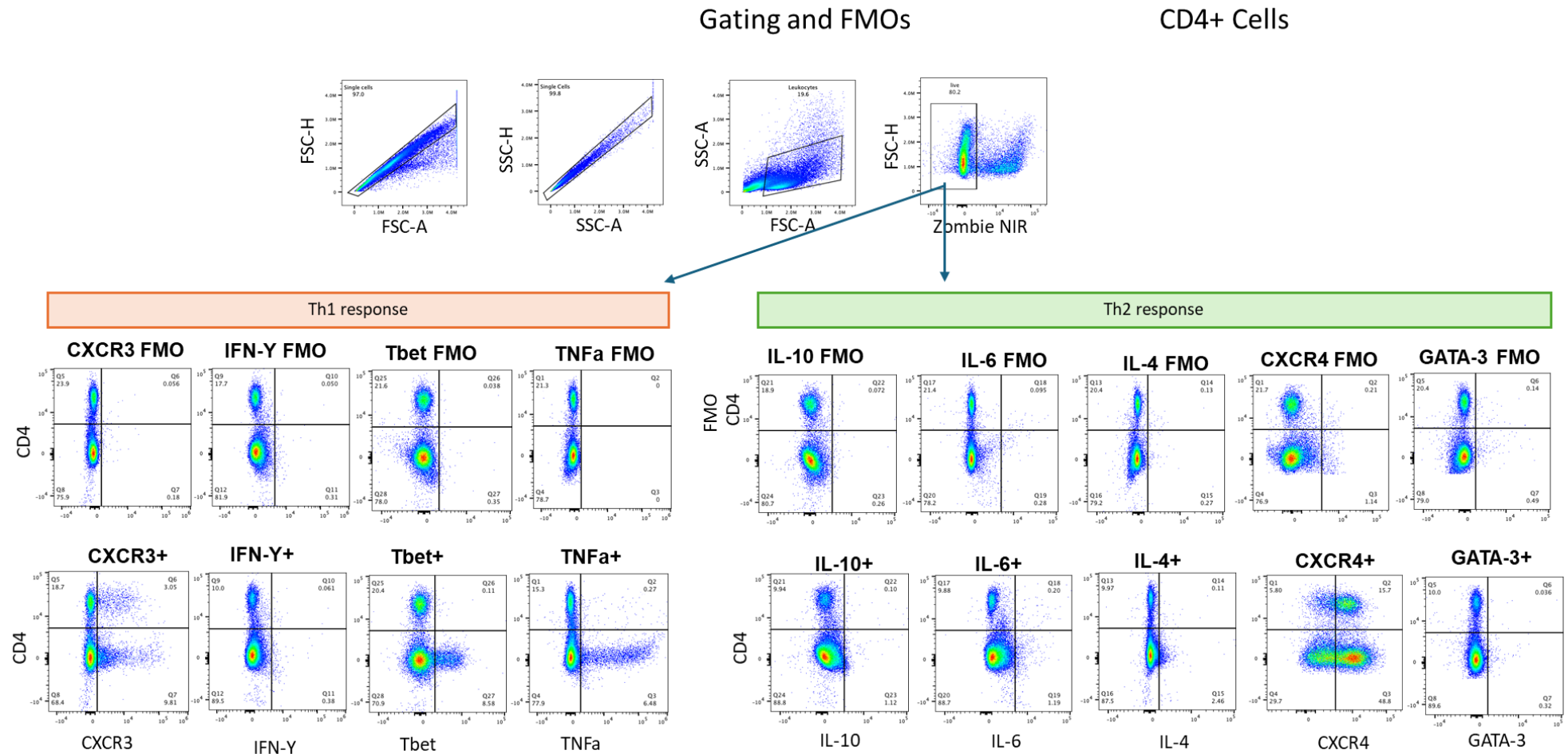


Figure S6. Gating and FMOs for CD4+ Cells

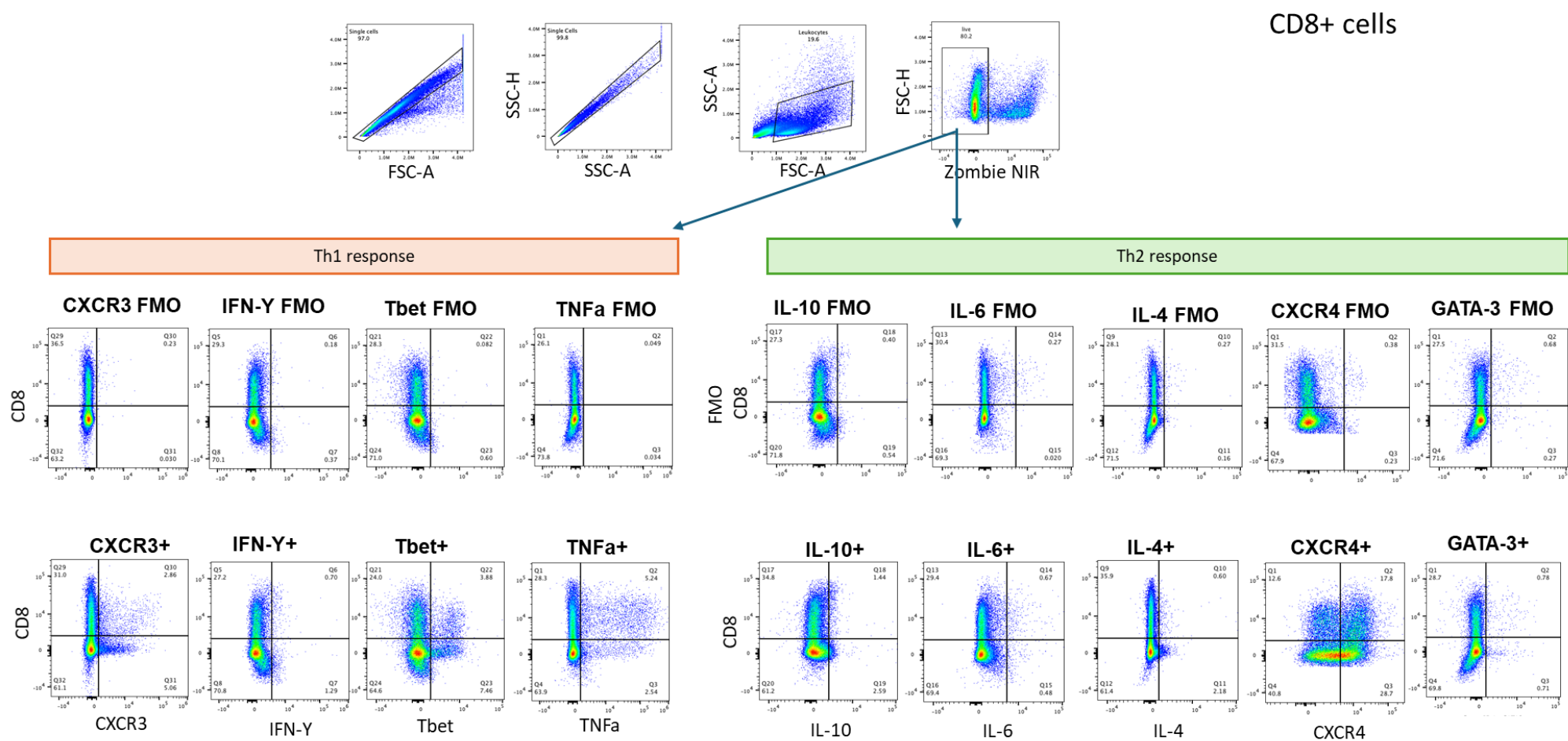


Figure S7. Gating and FMOs for CD8+ Cells