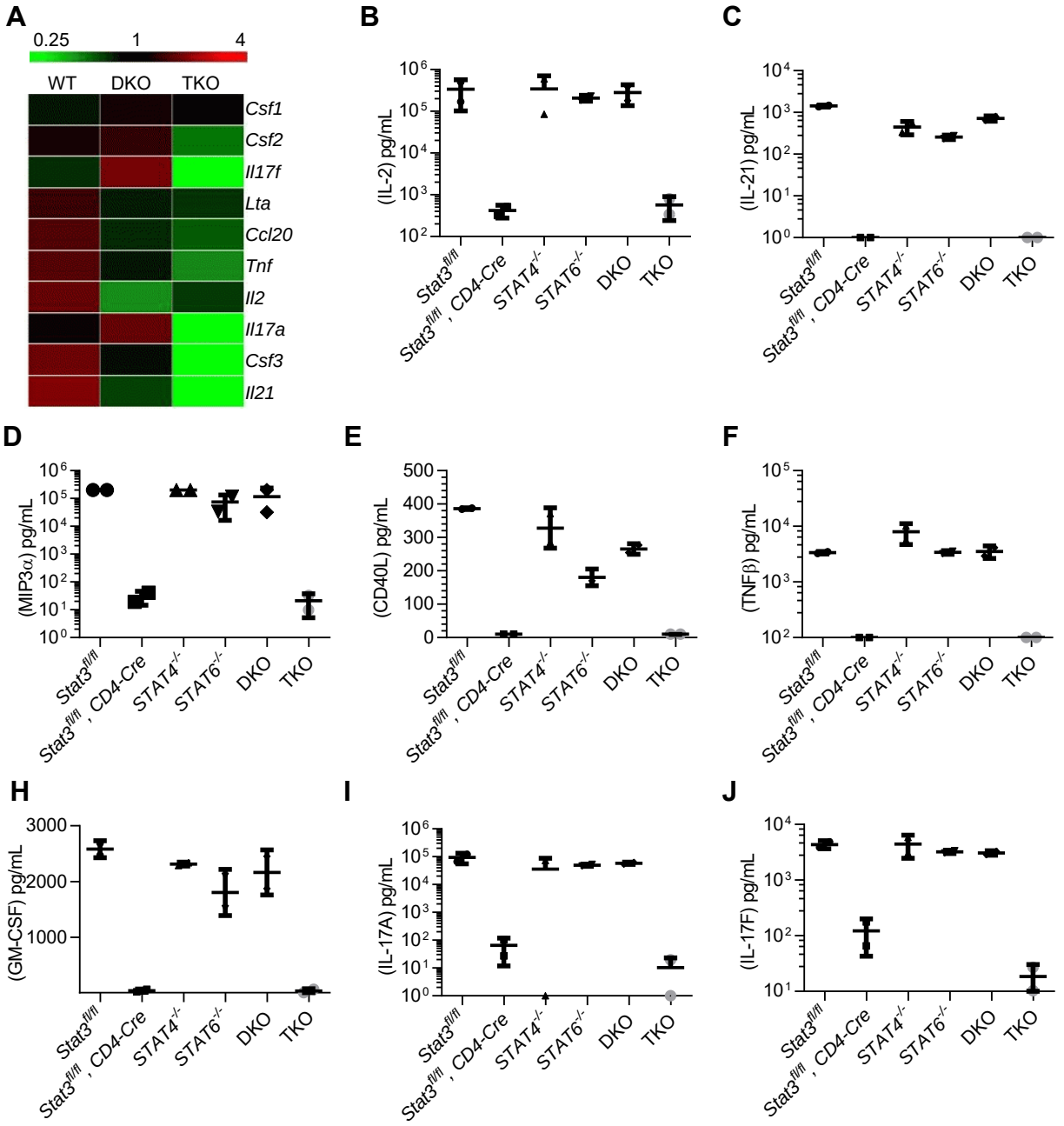
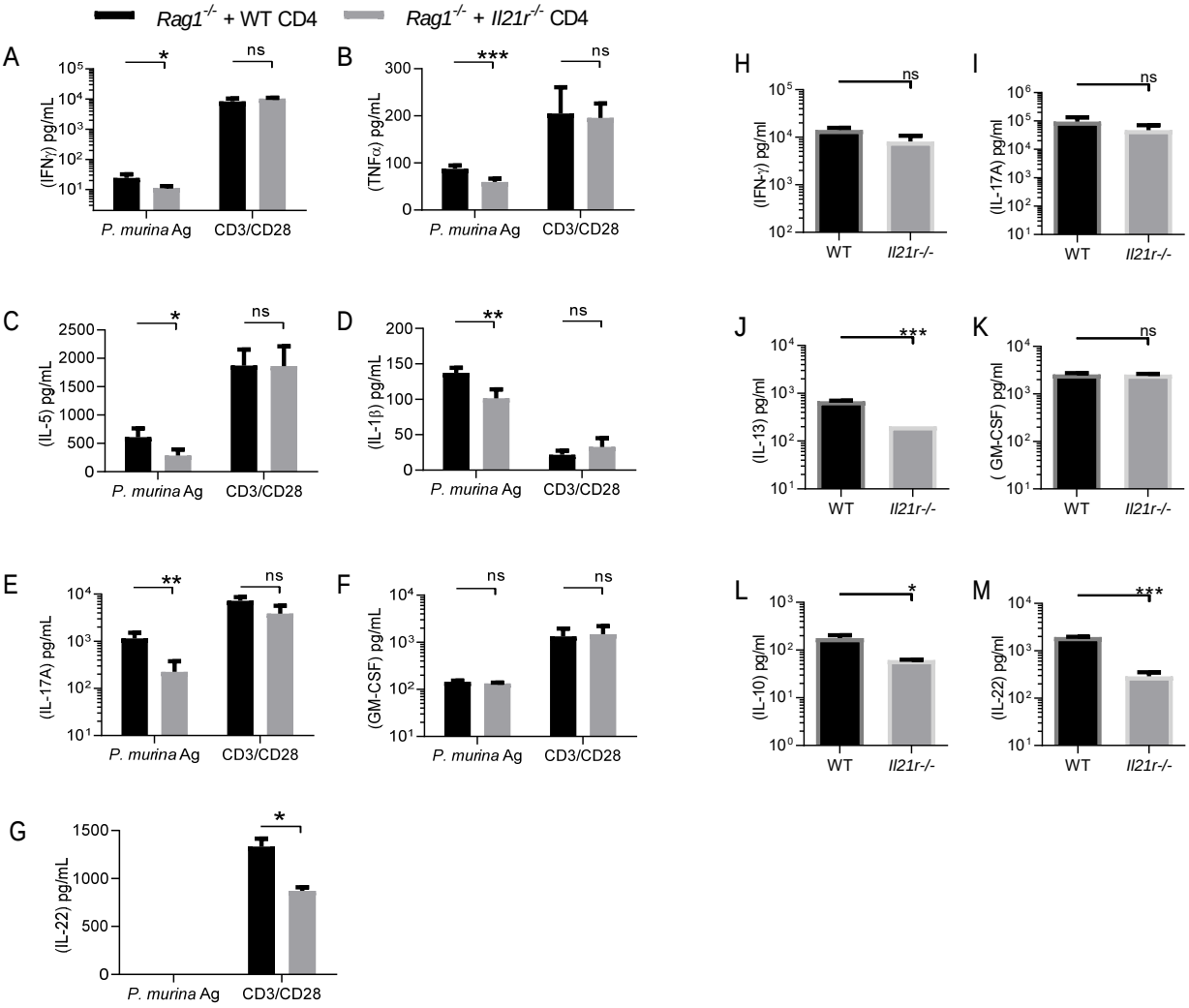
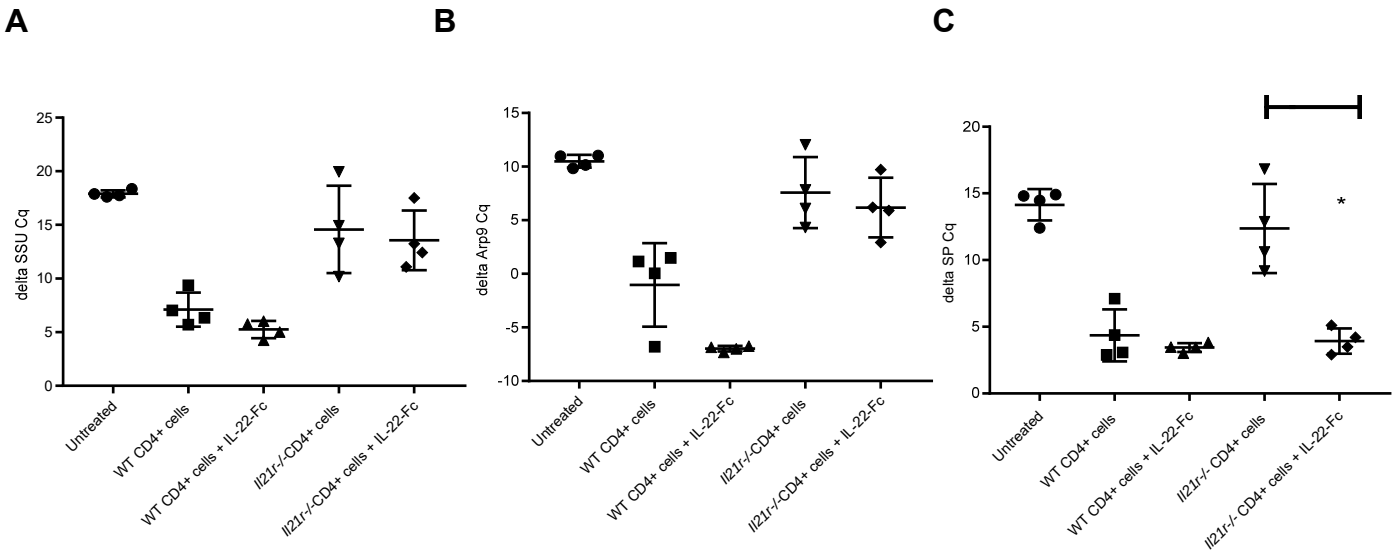


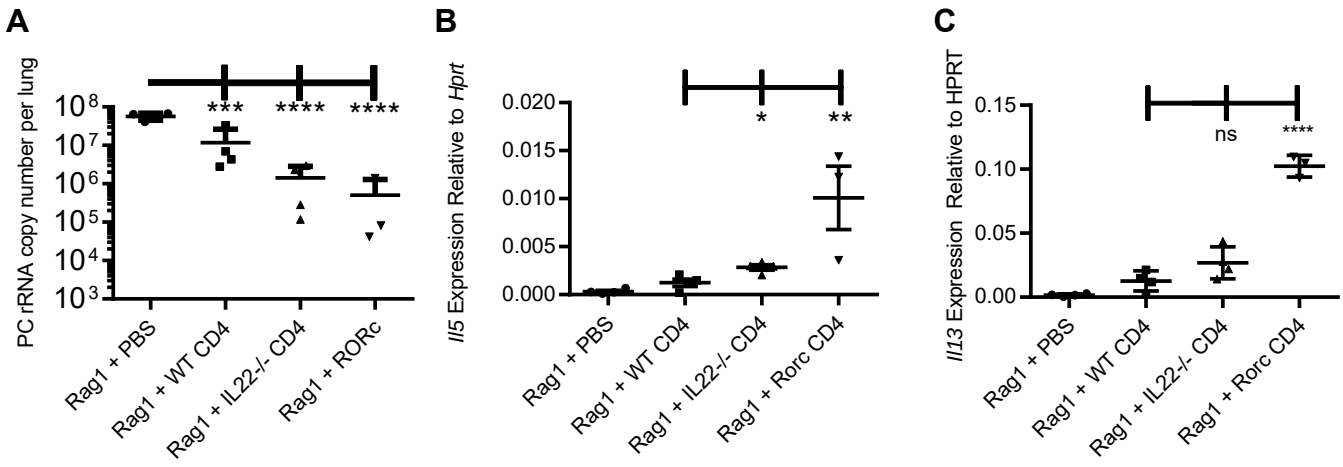
Supplementary Figure 1. STAT3 signaling is required intact T-cell responses. *Rag1*$^{-/-}$ mice received WT, *Stat4 Stat6* Double knockout, or *Stat4 Stat6 Stat3* Triple knockout purified splenic CD4+ T-cells, and infected for 2 weeks with *P. murina*. (**A**) Whole lung RNA was isolated, sequenced using an Illumina NextSeq 500, and analyzed for differential expression of genes associated with a STAT3 signaling are presented as heat map of the means (N=3). Naïve CD4+ T-cells were isolated and differentiated into T helper subsets in vitro. (**B-J**) Cytokine protein concentration in supernatants were measured using a multiplex kit. Values are represented as means ± SEM, N=2 per group. These assays were performed once. *P* values are annotated as follows (*) ≤0.05, (**) ≤0.01, (***) ≤0.001, and (****) ≤0.0001 (ANOVA).



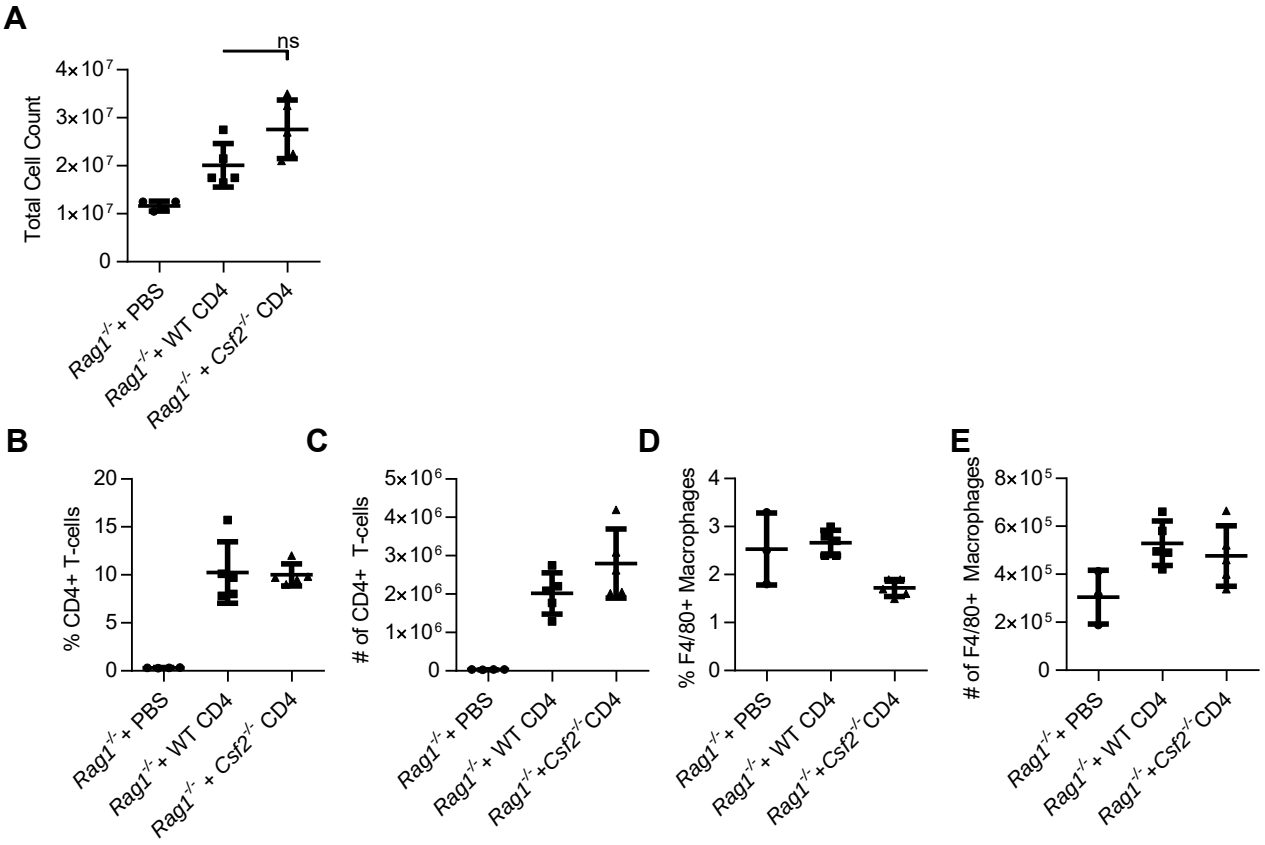
Supplementary Figure 2. *Il21r*$^{-/-}$ CD4+ T-cells are deficient in IL-22 production. *Rag1*$^{-/-}$ mice received WT or IL-21R deficient purified splenic CD4+ T-cells, and infected for 2 weeks with *P. murina*. (**A-G**) Whole lung cell suspensions were stimulated ex vivo with *P. murina* antigen or CD3/CD28 beads (N=3-4). Cytokine protein concentration in supernatants were measured using a multiplex kit or ELISA. Naïve CD4+ T-cells were isolated from uninfected WT and *Il21r*$^{-/-}$ mice and differentiated into T helper subsets in vitro (N=2). (**H-L**) Cytokine protein concentration in supernatants were measured using a multiplex kit. Values are represented as means ± SEM. A-F were performed once. *P* values are annotated as follows (*) ≤0.05, (**) ≤0.01, (***) ≤0.001, and (****) ≤0.0001 (ANOVA).



Supplementary Figure 3. IL-22 reduces troph burden in the adoptive transfer model. Wildtype (WT) and knockout CD4+ T-cells were adoptively transferred via I.V. injection to *Rag1*$^{-/-}$ mice 2 weeks prior to primary infection. Mice were then treated with IL-22-FC as described in Figure 3. Mice were sacrificed two weeks later and RT-PCR of whole lung RNA for (**A**) *P. murina* small subunit RNA was performed and quantified to assess degree of *Pneumocystis* burden, (**B**) *Arp9* (ascus) burden (**C**) *Sp* (troph) burden. *P* values are annotated as follows (*) ≤0.05, ANOVA, Tukey's multiple comparisons test.



Supplementary Figure 4. IL-22 is not required for Pneumocystis clearance. Wildtype (WT) and knockout CD4+ T-cells were adoptively transferred via I.V. injection to *Rag1*$^{-/-}$ mice 2 weeks prior to primary infection. RT-PCR of whole lung RNA for (**A**) *P. murina* mitochondrial ribosomal RNA large subunit was performed and quantified to assess degree of *Pneumocystis* burden, (**B**) *Il5* and (**C**) *Il13* expression to assess Th2 responses. Values are reported as means ± SEM for N=4 per group. This experiment was performed once. *P* values are annotated as follows (*) ≤0.05, (**) ≤0.01, (***) ≤0.001, and (****) ≤0.0001 (ANOVA).



Supplementary Figure 5. *CSF2*$^{-/-}$ CD4+ T-cells are proficient in macrophage recruitment. Wildtype (WT) and *Csf2*$^{-/-}$ CD4+ T-cells were adoptively transferred via I.V. injection to *Rag1*$^{-/-}$ mice 2 weeks prior to primary infection. Lungs were digested into a cell suspension, (**A**) counted, and stained to determine percent (**B**) and absolute number (**C**) of CD4+ T-cells, as well as percent (**D**) and absolute number (**E**) of F4/80+ macrophages. Values are reported as means ± SEM of percent parent gate or calculated absolute numbers (N=4 per group). A-E are representative data of 2 experiments. *P* values are annotated as follows (*) ≤0.05, (**) ≤0.01, (***) ≤0.001, and (****) ≤0.0001 (ANOVA).