**Figure S1.** **Serum cytokine profiles of patients who experienced cytokine storm during both protocols.** Patient ESO-3 (A) developed high fevers, fluid requirement, and diffuse pruritic skin rash with desquamation 14 days after ACT infusion. This reaction was also associated with significant peripheral eosinophilia, and was attributed to IL-2; symptoms resolved with fluid support and symptomatic care. Patient INY-4 (B) developed high fevers along with tachycardia, diastolic hypotension and lethargy. He also developed significant transaminitis. Tocilizumab (anti-IL-6) was given with significant improvement of fever, confusion and tachycardia, while the trasnaminitis resolved following administration of methylprednisolone. The cytokine storm was attributed to IL-2, while the liver toxicity was attributed to IL-2 or ipilimumab, not from the infused T cells or dendritic cells.

**Figure S2. Sustained clinical response in patient with synovial sarcoma.** Representative CT scan images of one of patient ESO-3’s lung metastases at baseline and following transgenic NY-ESO-1 TCR ACT with DC vaccination. Patient’s tumor masses continued to shrink over time, eventually leading to a CR.

**Figure S3. The NY-ESO TCR integrates randomly across a highly polyclonal endogenous TCR repertoire.** (A) To explore whether the NY-ESO transgenic TCR preferentially transduced/expressed in any pre-existing endogenous TCR clonotypes, we performed TCR deep sequencing on FACS-sorted NY-ESO-1 dextramer-positive infusion products, removed the dominant NY-ESO TCR sequence (indicated in blue), and calculated normalized Shannon entropy and clonality metrics for all infusion products. Each pie chart slice represents an individual TCR clonotype. (B) Summary of normalized entropy and clonality metrics for endogenous pre-existing TCR clonotypes of all infusion products and a healthy donor control (red). Normalized entropy values range from 0 to 1.  Values near 1 represent samples that are more random (more highly polyclonal), while values near 0 represent samples with one or a few predominant rearrangement (monoclonal or oligoclonal samples). Clonality values range from 0 to 1, and are the complement of normalized entropy. Values near 1 represent samples with one or a few predominant rearrangements (monoclonal or oligoclonal samples) dominating the observed repertoire. Clonality values near 0 represent more polyclonal samples.

**Figure S4. Non-NY-ESO-1 TCR diversity over time.** Individual patient-matched non-NY-ESO-1 TCR clonality (A) and entropy (B) at baseline and day +70 for ESO and INY cohorts (means indicated by bar). No significant differences between baseline and recovery non-NY-ESO-1 clonality or entropy values or between the two cohorts. (C) Change (Δ) in clonality and entropy over time in ESO and INY cohorts. No significant differences were noted in either metric over time between the two cohorts.

**Figure S5. Longitudinal profiling of serum Flt-3L levels and peripheral dendritic cell subpopulations in patients from both cohorts.** (A) Longitudinal serum Flt-3L levels through day +90 in patientsreceiving ipilimumab in addition to NY-ESO-1 transgenic T cells and DC vaccination (INY) and patients who did not receive ipilimumab (ESO). (B) Day +90 area under the curve (AUC) measurements for Flt-3L were significantly greater in the INY cohort compared to the ESO cohort (\*p<0.05). (C) Day +70 DC subpopulation proportions in INY and ESO cohorts determined via CyTOF. No significant differences were noted in the proportions of CD14+ DCs, myeloid DCs (mDCs), or plasmacytoid DCs (pDCs)