

**Table S1. Representation of all genes that are differentially expressed by at least 2 fold in restimulated helped versus helpless CD8<sup>+</sup> T cells**

Ref Number	Gene Symbol	Log2 Ratio	Num of Probes
NM_178894	AA792892	-2.88	1
NM_029131	4930503E14Rik	-2.79	1
NM_011022	Ott	-2.29	1
NM_028244	2600005C20Rik	-2.09	1
NM_172685	Slc25a24	-1.96	1
NM_020019	Magea6	-1.85	1
NM_022409	Zfp296	-1.84	1
NM_019642	Rpn2	-1.81	1
NM_053145	Pcdhb20	-1.8	1
NM_010283	Ggta1	-1.72	1
NM_178767	A530016O06Rik	-1.72	1
NM_207247	Pglyrp3	-1.63	1
NM_011683	V1ra1	-1.62	1
NM_008278	Hpgd	-1.62	1
NM_133208	Zfp287	-1.61	1
NM_153552	Thoc1	-1.6	1
NM_011798	Xcr1	-1.59	1
NM_145469	Npal2	-1.57	1
NM_015803	Atp8a2	-1.54	1
NM_172639	5330431N19Rik	-1.52	1
NM_023066	Asph	-1.49	1
NM_013589	Ltbp2	-1.47	1
NM_176924	9530053A07Rik	-1.47	1
NM_029031	Car1	-1.43	1
NM_145546	Gtf2b	-1.43	1
NM_145145	Pomt1	-1.43	1
NM_023868	Ryr2	-1.41	1
NM_015768	Prok2	-1.41	1
NM_177041	Flad1	-1.41	1
NM_177472	Btbd12	-1.41	1
NM_008136	Gna-rs1	-1.41	1
NM_011445	Sox6	-1.39	1
NM_013584	Lifr	-1.31	1
NM_053231	V1rc1	-1.31	1
NM_177338	Hmbox1	-1.3	1
NM_177545	Vangl1	-1.3	1
NM_175497	4732495G21Rik	-1.28	1
NM_029256	Ccdc83	-1.28	1
NM_053244	Kiss1r	-1.28	1
NM_008668	Nab2	-1.27	1
NM_010275	Gdnf	-1.26	1
NM_026454	Ube2f	-1.25	1
NM_146348	Olf1121	-1.24	1
NM_007727	Cntn1	-1.24	1
NM_024221	Pdhh	-1.23	1
NM_018751	Sult1c1	-1.23	1
NM_009089	Polr2a	-1.23	1
NM_172590	Wdr41	-1.22	1
NM_133791	Wwc2	-1.22	1

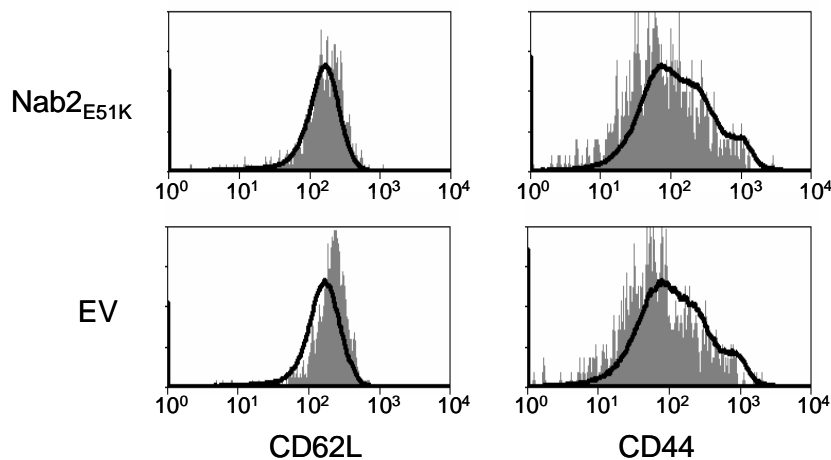
Ref Number	Gene Symbol	Log2 Ratio	Num of Probes
NM_008675	Nbl1	-1.22	1
NM_025575	2610042O14Rik	-1.21	1
NM_021288	Tyms	-1.21	1
NM_027629	Pgm2l1	-1.21	1
NM_172716	Pcgf3	-1.2	1
NM_177356	Lamp3	-1.2	1
NM_008651	Mybl1	-1.18	1
NM_011849	Nek4	-1.17	1
NM_175939	Adam29	-1.17	1
NM_152922	Egfl8	-1.16	1
NM_145935	Glyat	-1.15	1
NM_130903	Cd209c	-1.15	1
NM_009986	Cutl1	-1.15	1
NM_172882	Wdfy3	-1.14	1
NM_010432	Hipk1	-1.14	1
NM_153511	Ilf9	-1.14	1
NM_175477	Zfp574	-1.14	1
NM_027506	Gulp1	-1.13	1
NM_008086	Gas1	-1.13	1
NM_029697	1700128F08Rik	-1.12	1
NM_007764	Crkl	-1.12	1
NM_145355	Rnf185	-1.11	1
NM_172282	Tmco3	-1.11	1
NM_183424	P518	-1.1	1
NM_028744	Pi4k2b	-1.1	1
NM_177135	D830030K20Rik	-1.09	1
NM_145373	BC010462	-1.09	1
NM_016883	Psmc10	-1.09	1
NM_011703	Vipr1	-1.09	1
NM_015789	Dkk1l	-1.08	1
NM_015763	Lpin1	-1.08	1
NM_146622	Olf360	-1.08	1
NM_144904	Rod1	-1.08	1
NM_023063	Lima1	-1.07	1
NM_198308	4930402E16Rik	-1.07	1
NM_010731	Zbtb7a	-1.07	1
NM_030228	Gas2l1	-1.07	1
NM_177670	Tmem69	-1.07	1
NM_026820	Ifitm1	-1.07	1
NM_025352	Uqcrq	-1.07	1
NM_198666	MGC58177	-1.06	1
NM_013709	Sh3yl1	-1.06	1
NM_023266	Zfp120	-1.06	1
NM_207225	Hdac4	-1.06	1
NM_008077	Gad1	-1.06	1
NM_197981	5930416I19Rik	-1.06	1
NM_009726	Atp7a	-1.05	1
NM_172525	Arhgap29	-1.04	1
NM_026230	H2afy3	-1.04	1
NM_175247	Zfp28	-1.04	1
NM_011316	Saa4	-1.04	1
NM_130863	Adrbk1	-1.04	1

Ref Number	Gene Symbol	Log2 Ratio	Num of Probes
NM_007693	Chga	-1.04	1
NM_146426	Olfra469	-1.04	1
NM_009302	Swap70	-1.04	1
NM_028333	Angptl1	-1.03	1
NM_011768	Zfx	-1.03	1
NM_008489	Lbp	-1.02	1
NM_027063	1700013G24Rik	-1.02	1
NM_207140	Olfra1212	-1.02	1
NM_020252	Nrxn1	-1.02	1
NM_175025	Atp2c1	-1.02	1
NM_027597	4921509E07Rik	-1.02	1
NM_027872	1200006F02Rik	-1.01	1
NM_153168	Lars2	-1.01	1
NM_201355	BC047219	-1	1
NM_026879	Chmp2b	1	1
NM_008950	Psmc5	1	1
NM_008464	Klra6	1	1
NM_019827	Gsk3b	1	1
NM_010612	Kdr	1.01	1
NM_153789	Myliip	1.01	1
NM_174853	Disc1	1.01	1
NM_011133	Pole2	1.01	1
NM_029716	Chn1	1.02	1
NM_177198	4833432P19Rik	1.02	1
NM_009905	Clk1	1.02	1
NM_183298	Foxe1	1.03	1
NM_026952	Crkrs	1.03	1
NM_173184	Rln3	1.03	1
NM_173016	AI427515	1.03	1
NM_009775	Bzrp	1.03	1
NM_008391	Irf2	1.03	1
NM_019427	Epb.4.114b	1.03	1
NM_009558	Zfp51	1.03	1
NM_026425	Nat5	1.04	1
NM_153564	Gbp5	1.04	1
NM_031187	Tpsab1	1.04	1
NM_010840	Mthfr	1.05	1
NM_028173	Tram1	1.05	1
NM_007436	Aldh3a1	1.05	1
NM_009250	Serpini1	1.05	1
NM_007566	Birc6	1.05	1
NM_207244	Cd200r4	1.05	1
NM_025441	Sdccag1	1.05	2
NM_010136	Eomes	1.06	1
NM_134038	Slc16a6	1.06	1
NM_177589	Ulk4	1.06	1
NM_130881	Pabpc4	1.07	1
NM_009929	Col18a1	1.07	1
NM_028807	1200009I06Rik	1.07	1
NM_027545	Cwf1912	1.07	1
NM_011287	Rpl10a	1.07	1
NM_178254	Tcf15	1.07	1

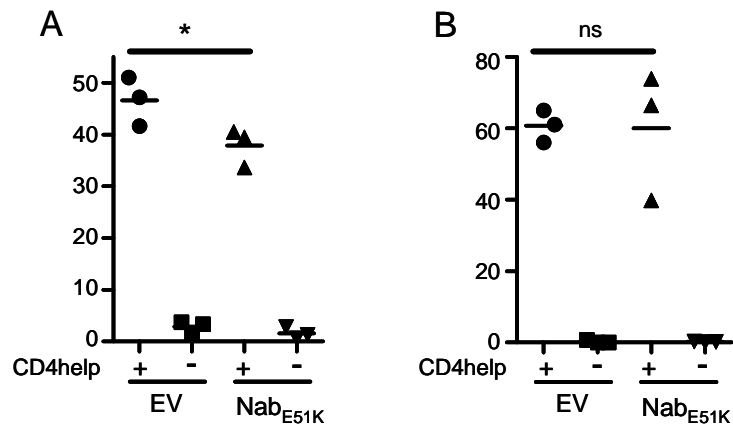
Ref Number	Gene Symbol	Log2 Ratio	Num of Probes
NM_011740	Ywhaz	1.07	1
NM_175666	Hist2h2bb	1.07	1
NM_026127	4833420G17Rik	1.08	1
NM_009741	Bcl2	1.08	1
NM_175223	Dnali1	1.08	1
NM_177888	Zfp78	1.08	1
NM_007479	Arf4	1.08	1
NM_177326	Pak2	1.09	1
NM_153081	Slc16a11	1.09	1
NM_011790	Arih2	1.09	1
NM_023434	5730589K01Rik	1.09	1
NM_175103	Bola2	1.09	1
NM_025850	Fank1	1.09	1
NM_025979	Mastl	1.1	1
NM_008431	Kcnk4	1.1	1
NM_007870	Dnase1l3	1.1	1
NM_011975	Rpl27a	1.11	1
NM_198033	Als4	1.11	1
NM_028595	Ms4a6c	1.11	1
NM_178615	Rgmb	1.11	1
NM_029499	Ms4a4c	1.11	1
NM_010280	Gfra3	1.13	1
NM_015830	Solh	1.14	1
NM_024255	Hsdl2	1.14	1
NM_153287	Axud1	1.14	1
NM_030676	Nr5a2	1.14	2
NM_025858	Scotin	1.14	1
NM_025303	Stau2	1.14	1
NM_018851	Samhd1	1.15	1
NM_133871	Ifi44	1.16	1
NM_010062	Dnase2a	1.16	1
NM_181570	Cdk8	1.16	1
NM_011451	Sphk1	1.16	1
NM_177861	Tmem67	1.16	1
NM_016739	Gpiap1	1.16	1
NM_176948	9330133O14Rik	1.17	1
NM_172495	Ncoa7	1.17	1
NM_010578	Itgb1	1.18	1
NM_177673	BC046331	1.18	1
NM_011050	Pdcd4	1.18	1
NM_008927	Map2k1	1.18	1
NM_023785	Cxcl7	1.19	1
NM_133966	Taf5l	1.19	1
NM_013886	Hdgfrp3	1.2	2
NM_025714	Odf2l	1.2	1
NM_145978	Pdim2	1.2	1
NM_172435	P2ry10	1.21	1
NM_023223	Cdc20	1.21	1
NM_008620	Mpa2	1.23	1
NM_008662	Myo6	1.23	1
NM_178446	BC013481	1.23	1
NM_029000	Gvin1	1.24	1

Ref Number	Gene Symbol	Log2 Ratio	Num of Probes
NM_145455	Btf3	1.24	1
NM_008741	Nsg2	1.24	1
NM_019919	Ltbp1	1.24	1
NM_033562	Derl2	1.25	1
NM_172988	Fbxl4	1.25	1
NM_028898	4932417H02Rik	1.26	1
NM_031999	Gpr137b	1.27	1
NM_010726	Phyh	1.28	1
NM_010261	Rabac1	1.28	1
NM_024195	Cyb5r4	1.28	1
NM_021338	Rpl35a	1.29	1
NM_027617	Spata1	1.29	1
NM_029522	Gpsm2	1.3	1
NM_147025	Olf380	1.3	1
NM_146008	Tcp11l2	1.31	1
NM_023215	2500003M10Rik	1.31	1
NM_011612	Tnfrsf9	1.32	1
NM_007521	Bach2	1.32	1
NM_152839	Igj	1.33	1
NM_011218	Ptprs	1.33	1
NM_010905	Nfia	1.34	1
NM_010411	Hdac3	1.34	1
NM_172572	Rhbdf2	1.35	1
NM_177863	Frem1	1.36	1
NM_175394	Wtap	1.38	1
NM_010780	Cma1	1.39	1
NM_007860	Dio1	1.4	1
NM_013621	Olf69	1.41	1
NM_146997	Olf178	1.41	1
NM_011504	Stxbp3a	1.41	1
NM_033552	Slc4a10	1.44	1
NM_019926	Mtm1	1.45	1
NM_021718	Ms4a4b	1.46	1
NM_010059	Dmc1h	1.46	1
NM_028266	Col16a1	1.46	1
NM_024470	Klra23	1.47	2
NM_053146	Pcdhb21	1.47	1
NM_145401	Prkag2	1.51	1
NM_017376	Tef	1.52	1
NM_009104	Rrm2	1.54	1
NM_025823	Pcyox1	1.58	1
NM_024413	Plekhf1	1.64	1
NM_183185	D930016N04Rik	1.65	1
NM_009437	Tst	1.65	1
NM_021538	Cope	1.68	1
NM_008331	Ifit1	1.68	1
NM_019935	Ovol1	1.7	1
NM_153161	BC037034	1.79	1
NM_008512	Lrp1	1.8	2
NM_023141	Tor3a	1.82	1
NM_053229	V1rb8	1.83	1
NM_009372	Tgif	1.91	1

Ref Number	Gene Symbol	Log2 Ratio	Num of Probes
NM_173369	Cyld	1.91	1
NM_011235	Rad51l3	1.92	1
NM_019639	Ubc	1.92	4
NM_175362	Card11	1.92	1
NM_174989	Ticam1	1.94	1
NM_009992	Cyp1a1	1.98	1
NM_008376	Gimap1	2.22	1
NM_008369	Il3ra	2.34	1
NM_144924	Tbc1d17	2.55	1
NM_008358	Il15ra	2.6	1
NM_010397	H2-T22	2.66	1
NM_009735	B2m	2.95	2
NM_008329	Ifi204	2.95	1
NM_007393	Actb	3.43	3
NM_007907	Eef2	3.6	2
NM_011701	Vim	3.72	2



**Figure S1. Expression of CD62L and CD44 of naïve OT-I/Nab2<sub>E51K</sub> and OT-I/EV T cells is comparable to unmanipulated, naïve OT1 T cells.** Nab2<sub>E51K</sub> or the EV-expressing OT-I thymocytes were injected intrathymically into primary recipient mice. Two weeks later, CD8<sup>+</sup> T cells were isolated from spleens and lymph nodes, and CD62L and CD44 expression levels were determined of GFP<sup>+</sup> OTI T cells (filled), and compared to age/sex-matched untreated OT-I T cells (black line).



**Figure S2. Secondary expansion of CD8<sup>+</sup> sorted, Nab2<sub>E51K</sub><sup>-</sup>, or EV-expressing T cells**  
 60 naïve OTI-Nab2<sub>E51K</sub><sup>-</sup>, or OTI-EV cells were transferred into C57BL/6J mice prior to immunization with OVA-loaded splenocytes in a helped or helpless setting. 7 days later, CD8<sup>+</sup> T cells were isolated and the amount of OVA<sub>257-264</sub>-specific T cells was determined by K<sup>b</sup>-OVA<sub>257-264</sub> tetramer staining. The number of OVA<sub>257-264</sub>-specific T cells was re-assessed after restimulation with MEC.B7.SigOVA cells for 7 days in a ratio of 25:1. The fold expansion was determined for (A) OTI-Nab2<sub>E51K</sub><sup>-</sup>, or OTI-EV cells, and for (B) the corresponding endogenous OVA<sub>257-264</sub>-specific CD8<sup>+</sup> T cell responses. Each data point represents the CD8<sup>+</sup> T cells pooled from two individual mice, with three biological replicates. \*= $p < 0.05$ .