Supplementary Table 1. Functional avidities of survivin-specific T-cell clones against LML-peptide pulsed T2 cells.

clone	avidity by 4-hour ^{51}Cr-release assay 50% lysis at E:T 10:1 [LML peptide, M]
#24	$5x10^{-8}$
Published TCRs with fratricide:	
A66	$5x10^{-8}$
A71	$1.3x10^{-6}$
A72	$5x10^{-11}$

TCRs A66, A71 and A72 are published allo-restricted survivin-specific TCRs (7).

Supplementary Table 2. Survivin-specific TCR α-chain usage.

clone	TRAV	TRAJ	C	AA junction
s24	13-2*01	24*02	A	CAETVTDSWGKLQF
Published TCRs with fratricide:				
A66	13-1*02	39*01	A	CAARAGNMLTF
A71	12-2*01	31*01	A	CAVNNARLMF
A72	14/ DV4*02	4*01	A	CAMREGGGYNKLIF

Nomenclature according to the international Immunogenetics information system website www.imgt.org

Sequences of TCRs A66, A71 and A72 are published allo-restricted survivin-specific TCRs with fratricide (7).

Supplementary Table 3. Survivin-specific TCR β-chain usage.

clone	TRBV	TRBD	TRBJ	C	AA junction
s24	15*02	1*01	1-5*01	B1	CATSRGDSTAEPQHF
Published TCRs with fratricide:					
A66	30*01	2*01	2-7*01	B1	CAWGTGLALYEQYF
A71	30*01	1*01	2-1*01	B1	CAWSIGAEQFF
A72	30*02	1*01	1-1*01	B1	CAGQDLNTEAFF

Nomenclature according to the international Immunogenetics information system website www.imgt.org

Sequences of TCRs A66, A71 and A72 are published allo-restricted survivin-specific TCRs with fratricide (7).

Supplementary Table 4. Energetic contribution at the TCR-peptide-HLA binding interfaces.

	Total energy [Rosetta units]	Interface energy [Rosetta units]	Interface energy percentage
s24-HLA-survivin	-450.22	-10.36	
s24-HLA		-6.07	59%
s24-survivin		-3.82	37%
A72-HLA-survivin	-462.49	-10.27	
A72-HLA		-7.32	74%
A72-survivin		-2.60	25%

Supplementary Table 5. Different molecular recognition patterns of autologous versus allogeneic repertoire derived survivin-TCRs.

#	Peptide sequence, conserved residues (yellow)										Antigen	Abbrevi-ation	Reactive[A] TCR s24	A72
	E	L	T	L	G	E	F	L	K	L	Survivin	ELT	Yes	Yes
1		L	A	L	G	V	F	C	F	A	CD3d	LAL	No	Yes
2	L	L	A	L	G	V	F	C	F	A	CD3d	LLA	No	No
3	Q	C	L	L	G	T	F	F	T	C	CD81	QCL	No	Yes
4	H	I	I	L	G	L	F	G	L	L	CSF3R	HII	No	No
5	N	I	A	L	G	V	F	A	L	A	CRLS1	NIA	No	No
6	Q	L	L	L	G	Q	F	T	L	L	EPB42	QLL	No	No
7	L	L	L	L	G	V	F	A	A	A	INGR2	LLL	No	No
8	Q	A	Y	L	A	L	F	L	K	L	WDR36	QAY	No	Yes

[A]Epitopes predicted by computational and alanine-substitution analyses were loaded on T2 cells and reactivity by s24-TCR$^+$ or A72-TCR$^+$ T cells assessed by IFN-γ ELISpot assays. Representative results of 3 donors.

Abbreviations: CD3d: CD3 delta; CD81: CD81 antigen; CSF3R: Granulocyte colony stimulating factor receptor; CRLS1: cardiolipin synthase; EPB42: Erythrocyte membrane protein band 4.2.; INGR2: Interferon gamma receptor 2; WDR36: WD-repeat containing protein 36.

Supplementary Table 6. Potential for recognition of alternative epitopes by TCRs derived from autologous versus allogeneic repertoires.

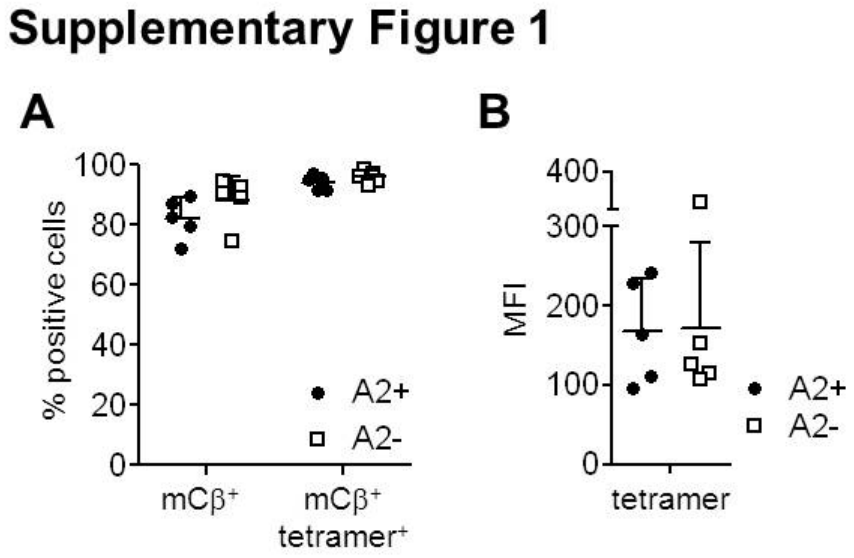
Antigen	Epitope	TCR	Motif	Derived from	# of alternative epitopes (by sequence)
Survivin	ELTLGEFLKL	s24	**X**LT**X**GEFLK**X**	Auto	0
Survivin	ELTLGEFLKL	s16	**X**LTLGEFLKL	Auto	0
PRAME	NLTHVLYPV	p11	N**XX**H**X**LY**X**V	Auto	3[A]
PRAME	NLTHVLYPV	p28	**XX**T**X**VLYPV **XX**T**XX**LYPV	Auto	0 5[B]
PRAME	ALYVDSLFFL	p300	ALY**X**D**X**LFF**X**	Auto	0
Survivin	ELTLGEFLKL	A72	**XXX**L**XX**FLKL **XXXXXX**FLKL	Allo	51 451
Tyrosinase	YMDGTMSQV	T58	Y**X**DGT**XXXX** Y**X**D**X**T**XXXX**	Allo	111 1595
MART-1	ELAGIGILTV	M1-29	**XXXX**I**X**ILT**X** **XXXX**I**XXXXX**	Allo	329 >4000[C]
MART-1	ELAGIGILTV	M1-67	**XXXX**I**X**I**XXX** **XXXX**I**XXXXX**	Allo	>4000[C] >4000[C]

[A]5-hydroxytryptamine receptor 1B, DNA polymerase theta, EF-hand domain-containing family member B.

[B]Cytochrome P450 11B1, mitochondrial; Cytochrome P450 11B2, mitochondrial; Sterol 26-hydroxylase, mitochondrial; Phosphatidylinositol 3-kinase regulatory subunit beta, Transmembrane protein 207.

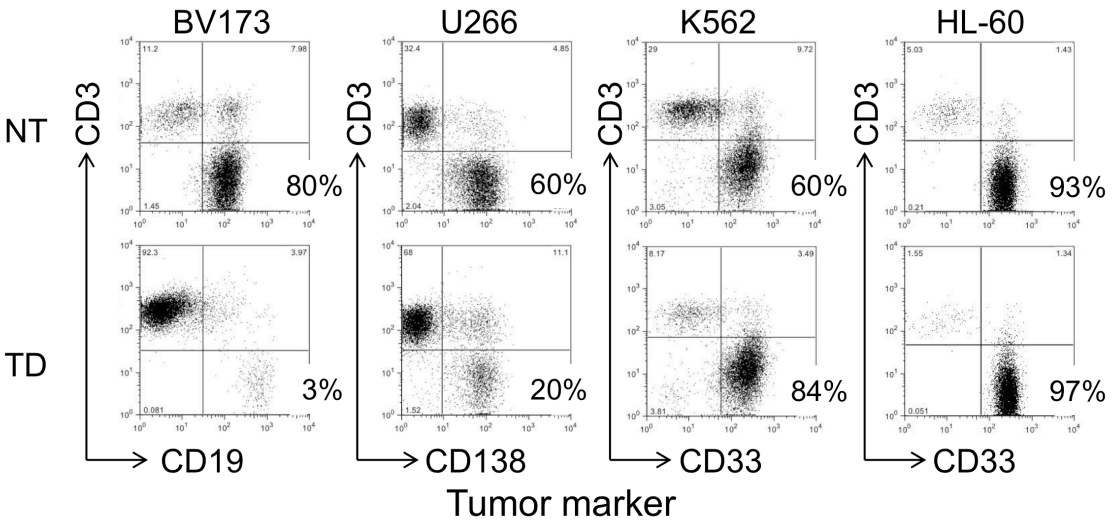
[C]Search cancelled by expasy website, motif is too degenerate.

Supplementary Figures



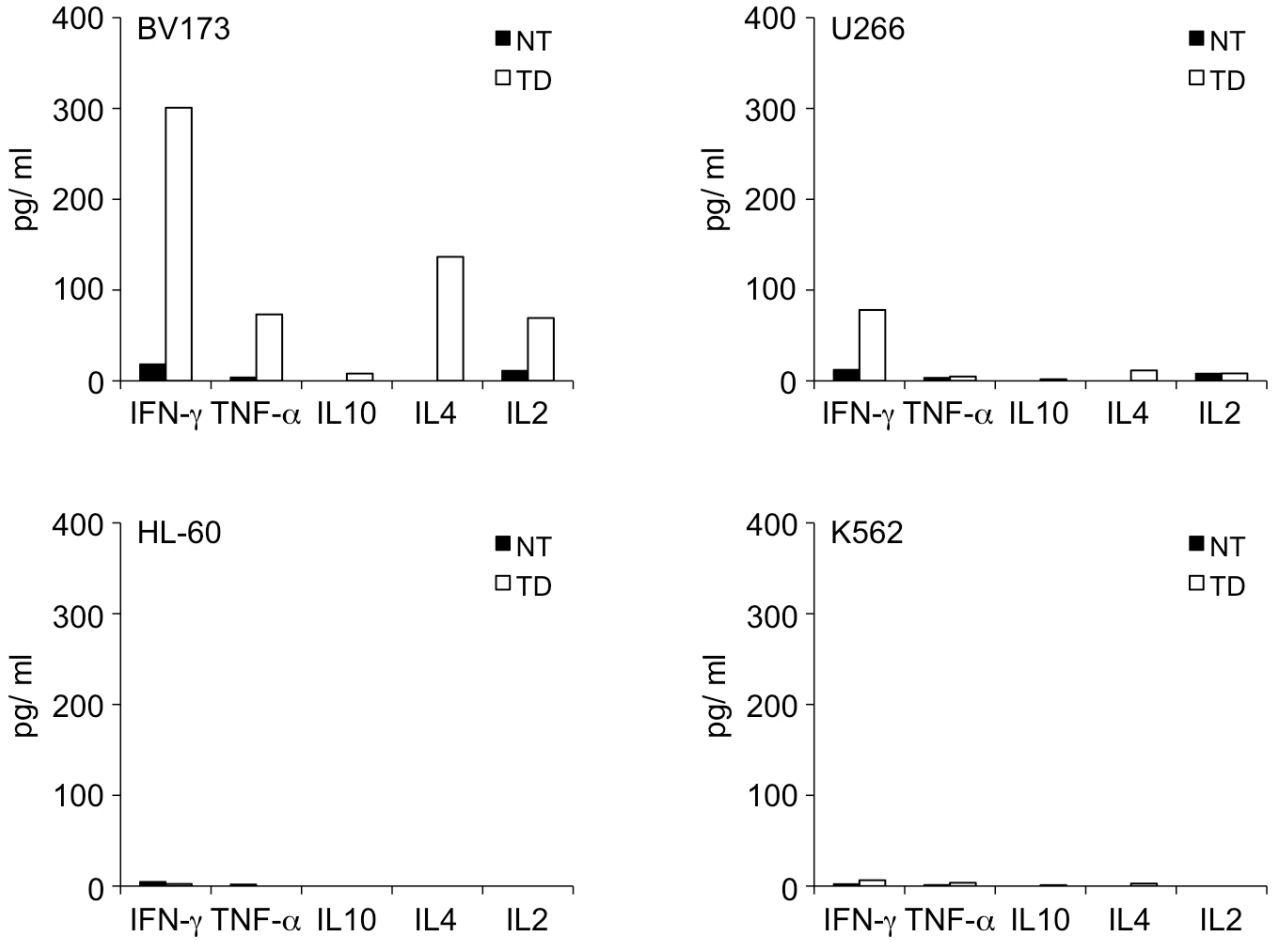
Supplementary Figure 1. Transgenic TCR expression in HLA-A2$^+$ and HLA-A2$^-$ donors is comparable. Survivin-TCR transduced CD8$^+$ T cells from HLA-A*02$^+$ (black circles) and HLA-A*02$^-$ (open squares) healthy adult donors after 2 antigen-specific stimulations were compared for transduction efficiency and tetramer mean fluorescence intensity (MFI). (**A**) Percentage of mCβ$^+$ and LML-tetramer$^+$ cells and (**B**) MFI of LML-tetramer in HLA-A2$^+$ and HLA-A2$^-$ transduced T cells. Mean ± SD, n=5.

Supplementary Figure 2



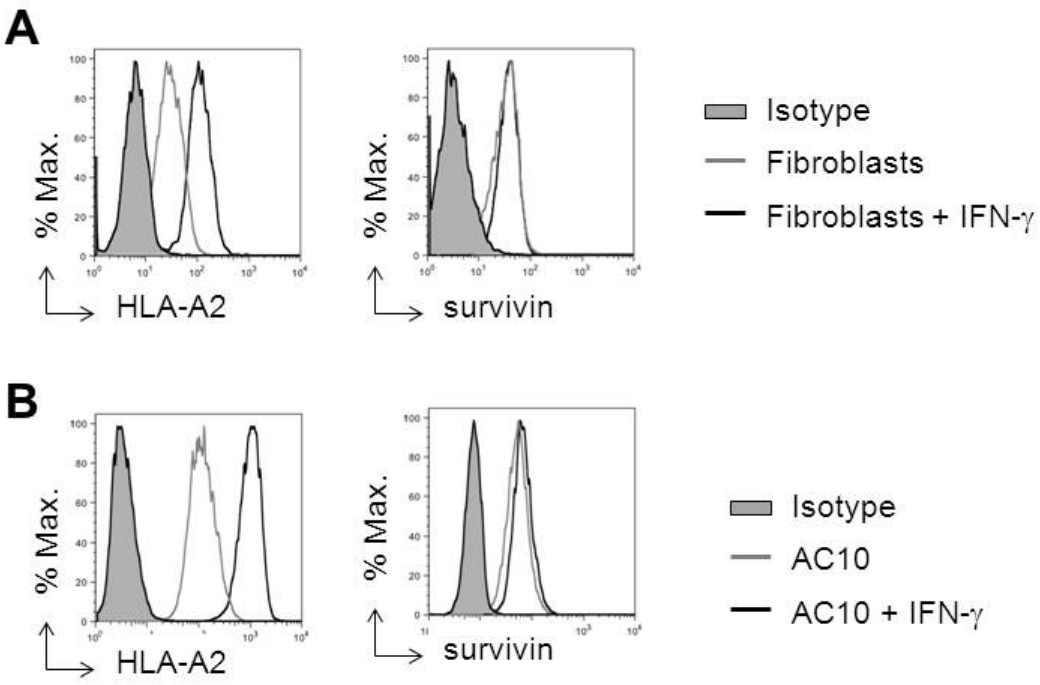
Supplementary Figure 2. Representative FACS analysis of co-cultures. Co-culture of control T cells (NT, top row) or survivin TCR$^+$ T cells (TD, lower row) with HLA-A*02$^+$survivin$^+$ (BV173, U266) or HLA-A*02$^-$ survivin$^+$ (HL-60, K562) cancer cell lines at an E:T ratio of 5:1 in the absence of cytokines. FACS analysis on day 5 shows staining for CD3 (T cells) and the tumor markers CD19 (BV173), CD138 (U266), CD33 (HL-60 and K562). One experiment representative of eight donors shown.

Supplementary Figure 3



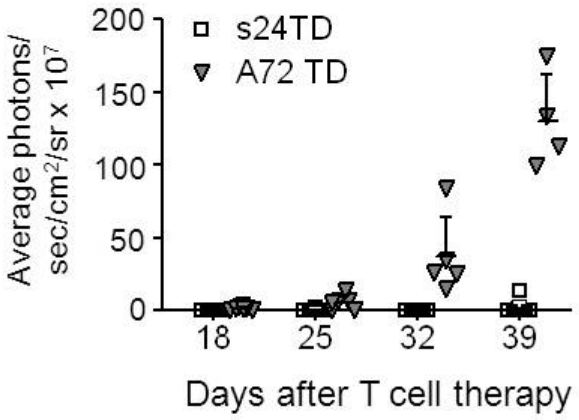
Supplementary Figure 3. Cytokine production of TCR$^+$ T cells in co-culture. Analysis by cytometric bead array (CBA) of supernatant collected after 24 hours from co-cultures to determine the concentrations (pg/ml) of Interferon-γ (IFN-γ), Tumor Necrosis Factor- α (TNF-α), IL10, IL4 and IL2 by TCR$^+$ T cells (TD, white bars) and control (NT, black bars). Shown is 1 experiment representative of 2 donors.

Supplementary Figure 4



Supplementary Figure 4. HLA-A2 and survivin expression of fibroblasts and cardiomyocytes. FACS analysis of fibroblasts (**A**) and the cardiomyocyte cell line AC10 (**B**) for HLA-A2 (surface) and survivin (intracellular) without (gray line) or with (black line) IFN-γ treatment. Isotype control (black line, shaded area).

Supplementary Figure 5



Supplementary Figure 5. Anti-tumor activity of s24- versus A72-TCR$^+$ T cells in vivo in the BV173 mouse model. Same experimental plan as depicted in Figure 5A comparing anti-tumor activity of s24-TCR$^+$ T cells (n=15) and A72-TCR$^+$ T cells (n=10) in mice by BLI. The intensity signals were log-transformed and the response profiles over time were analyzed using the robust generalized estimating equations method ($p<0.0001$).