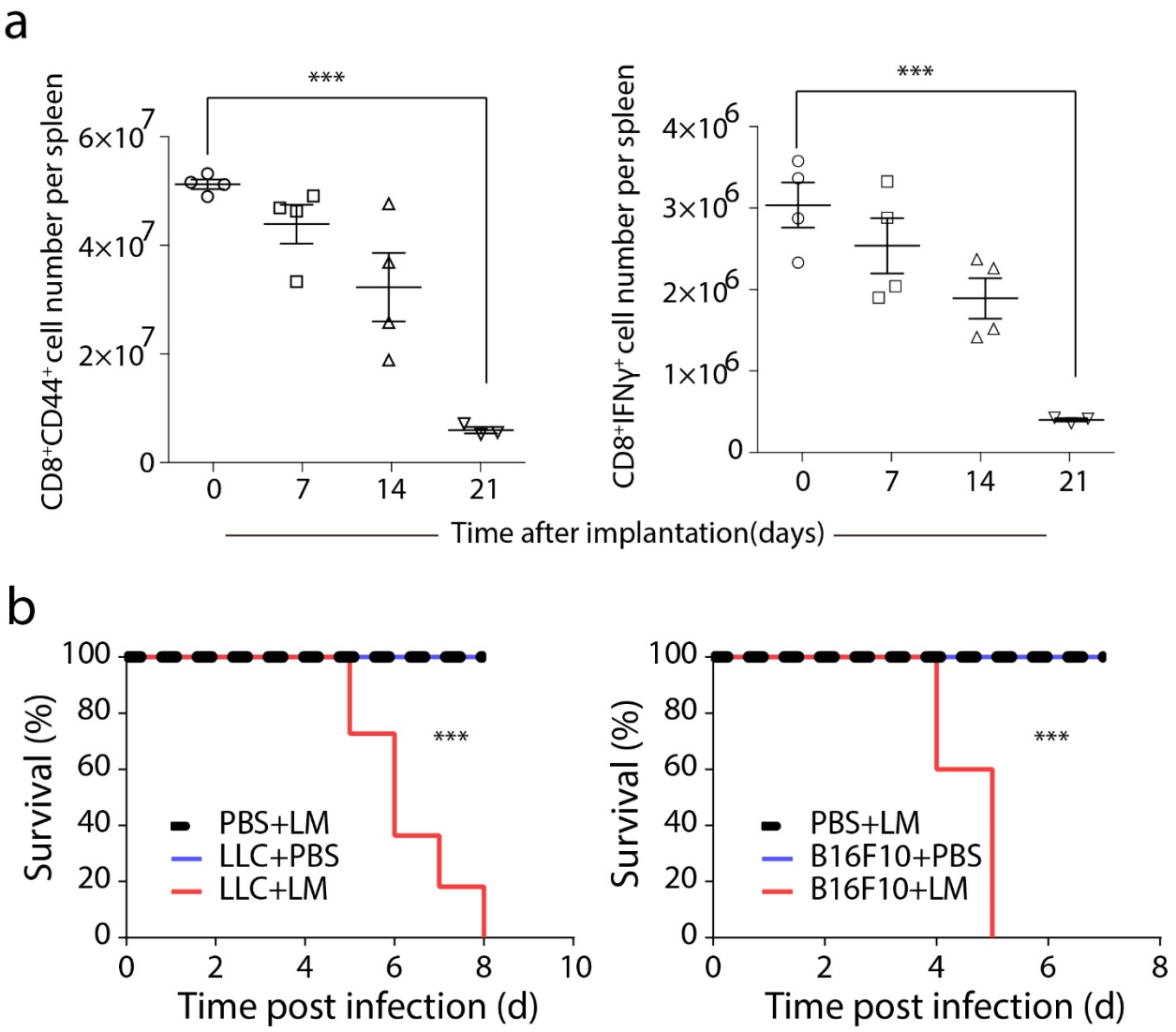
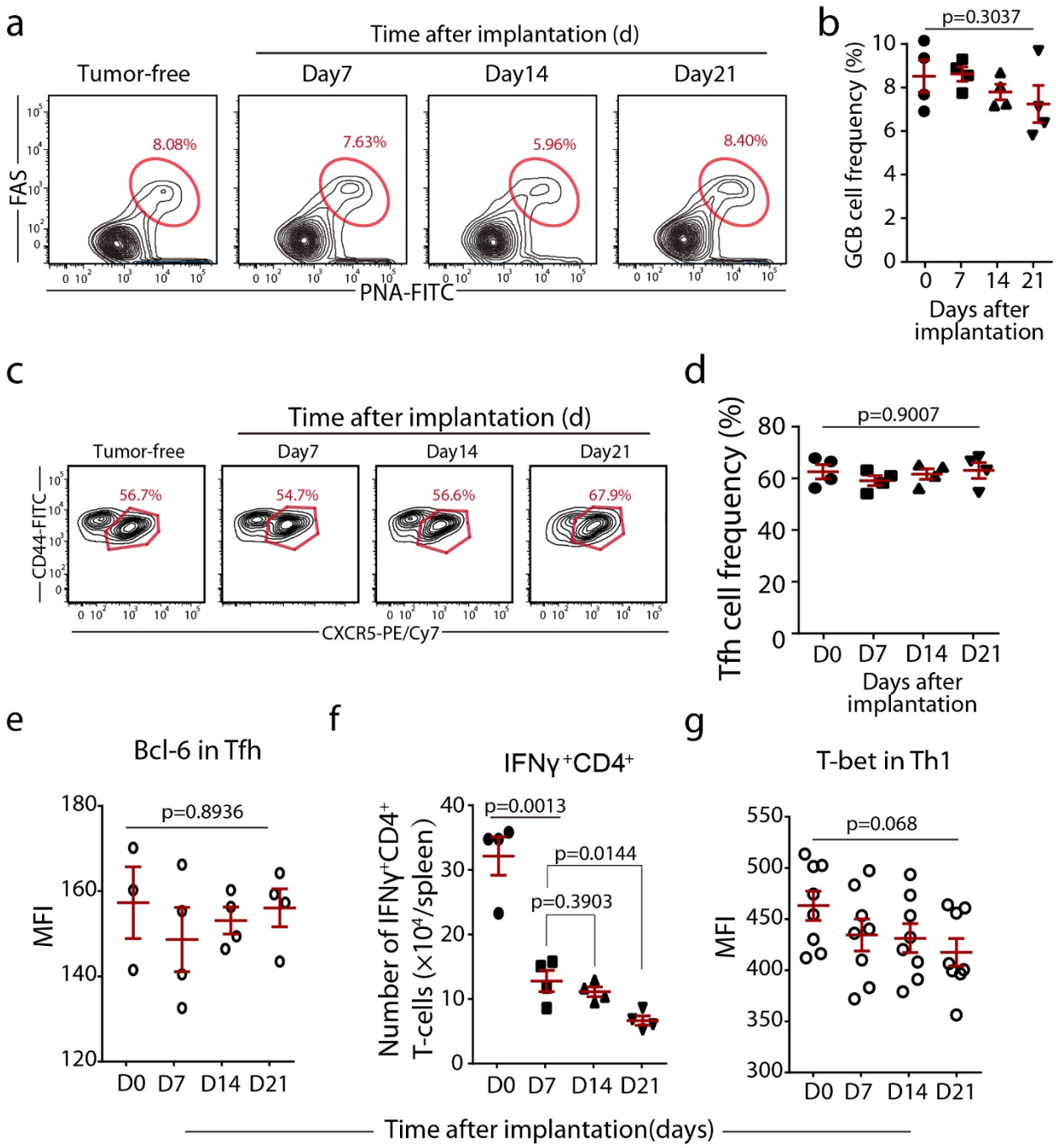
Supplementary Figures and Legends

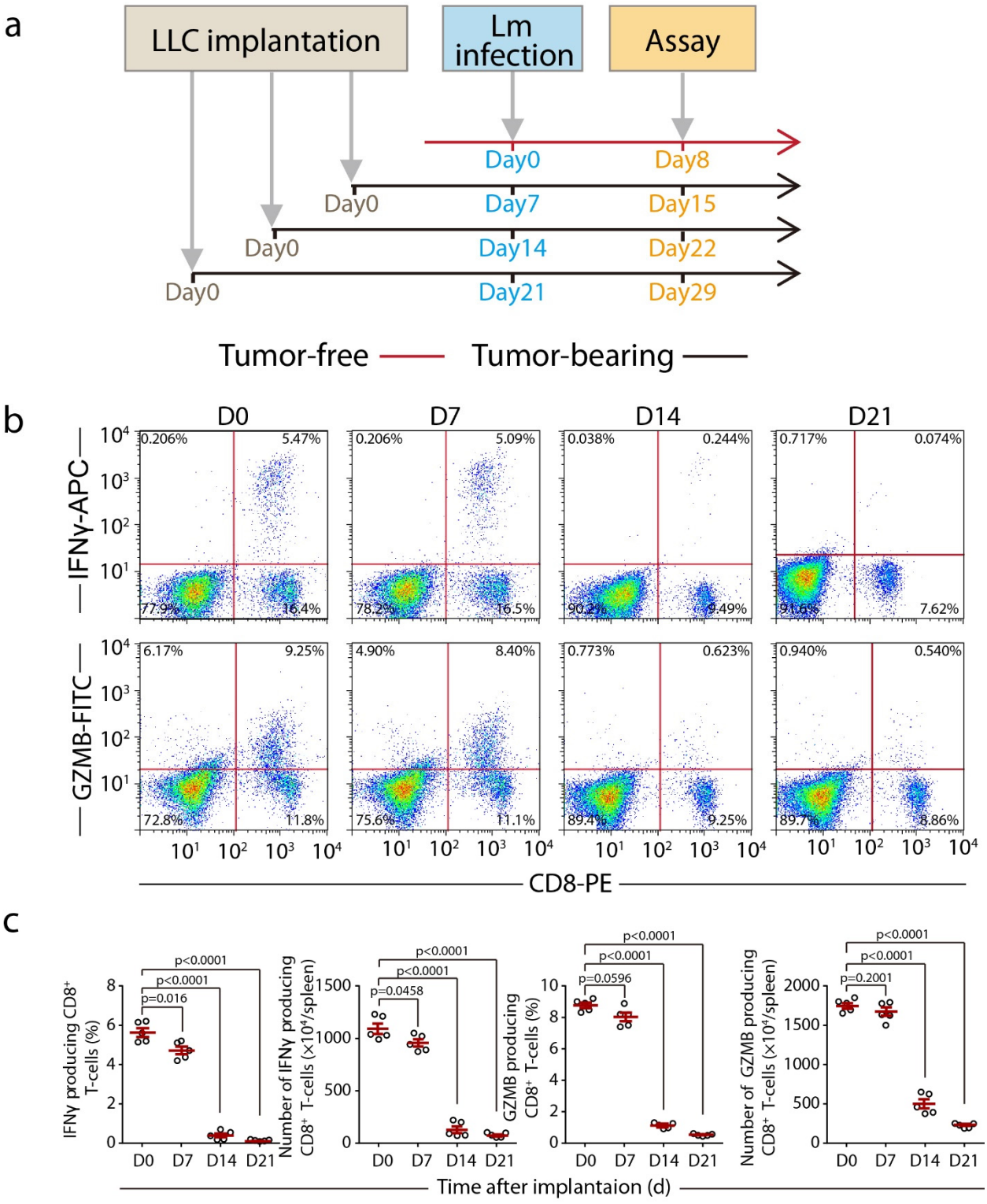


Supplementary Fig. 1. Reduced CD8$^+$ T cell response and survival of tumor-bearing mice following viral infection. a, Mice were infected with LCMV-Armstrong at different time points following LLC inoculation (0, 7, 14 and 21 days) and sacrificed on day 8 post-infection. The total numbers of CD8$^+$CD44$^+$ T cells and IFN-γ producing CD8$^+$ T cells stimulated with viral antigen in the spleens were analyzed. **b,** 14 days after LLC cell inoculation, or 10 days after B16F10 melanoma cell inoculation, tumor-bearing mice (n=10) were infected with 2×10^5 CFU rLmOVA. Infected, non-tumor-bearing mice (n=10) and uninfected tumor-bearing mice (n=10) were used as controls. Mouse survival time was analyzed and plotted.



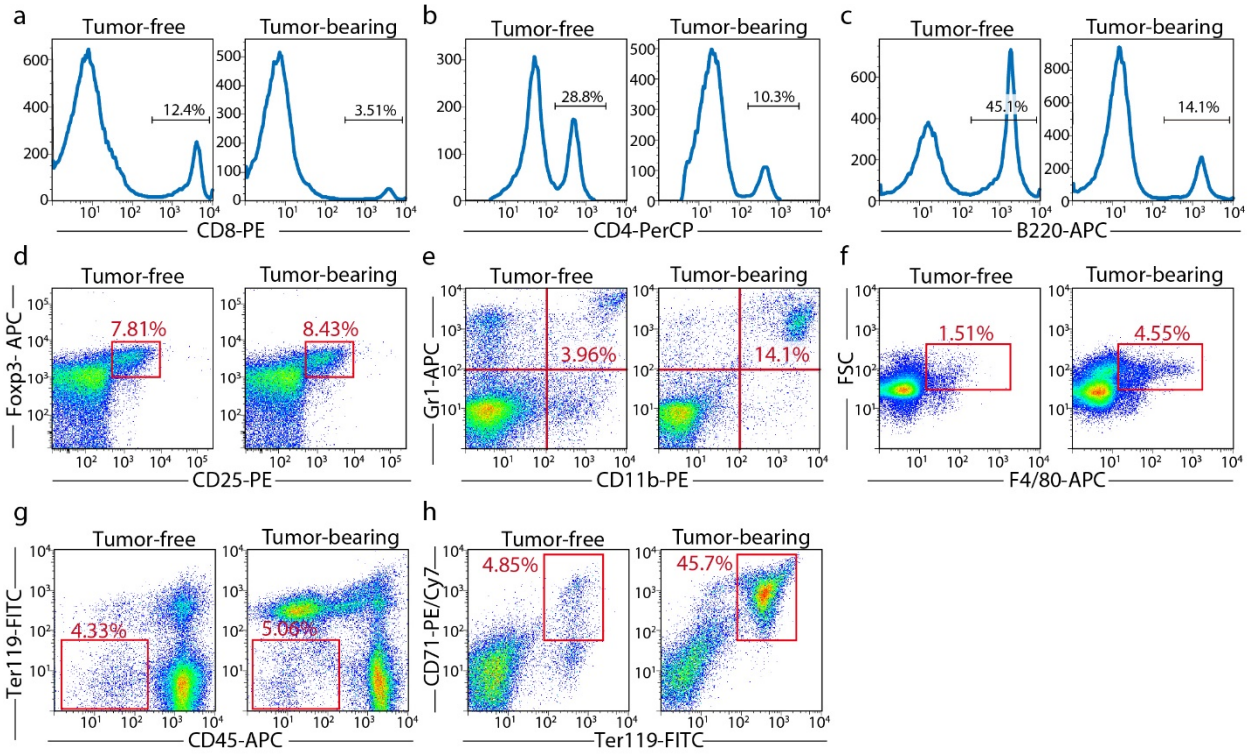
Supplementary Fig. 2. Infection-induced differentiation of germinal center B cells and Tfh cells is not affected in tumor-bearing mice. a-b, Mice were infected with LCMV-Cl_{13} at the indicated times after LLC inoculation and sacrificed on day 8 post-infection. Representative flow cytometry plots **(a)** and cumulative composite data **(b)** show the frequency of germinal center B cells (GCB, gated on B220) in the spleens of LCMV CL13-infected tumor-bearing mice at different time points (0, 7, 14 and 21 days, n=4) after LLC inoculation. **c-d,** Representative flow cytometry plots **(c)** and cumulative composite data **(d)** show Tfh cell differentiation cells in spleen (n=4). **e,** Tfh cell Bcl-6 expression in the spleens of tumor-bearing mice at the indicated time points (n=3 or 4) was detected by flow cytometry. **f,** Splenocytes were collected from mice

at the indicated times (n=4) after tumor inoculation and 8 days after LCMV infection. Cells were stimulated in vitro with GP a.a.61-80 peptide, and the number of antigen-specific $CD4^+$ T cells was determined by intracellular IFN-γ staining and flow cytometry. **g,** T-bet expression in Th1 cells in the spleens of tumor-bearing mice at the indicated time points (n=8) was determined by flow cytometry. Data are representative of at least three independent experiments. Two-tailed Student's t-tests were used for all analyses. Error bars represent the means ± SEM.

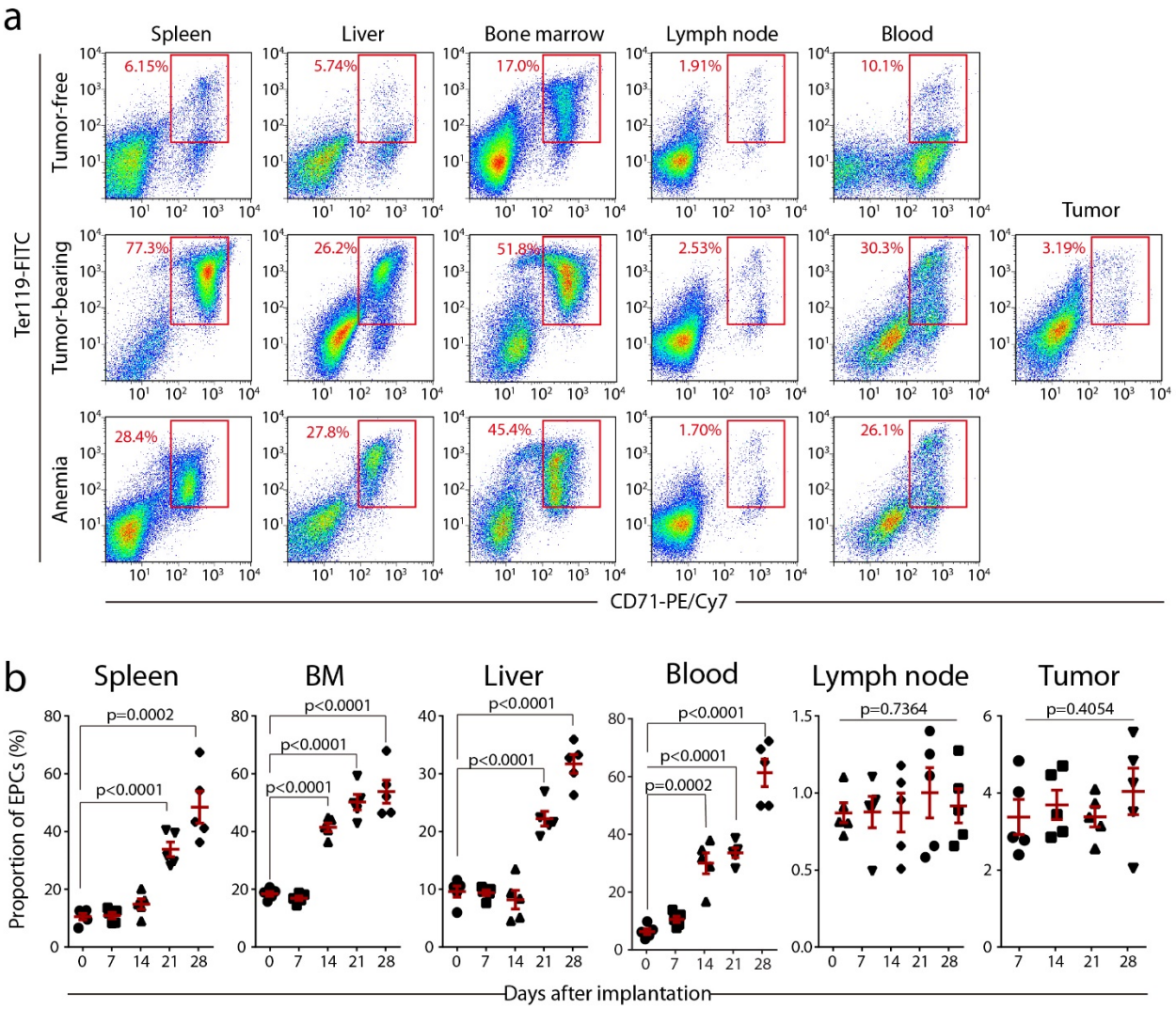


Supplementary Fig. 3. Impaired anti-bacterial response of CD8$^+$ T cells in mice with established tumors. a, Schematic of experimental procedure. Mice were infected with 4×10^6 CFU △actArLmOVA at different time points (0, 7, 14 and 21 days, n=5) after LLC inoculation and sacrificed on day 7 post-infection. **b**, Antigen-specific CD8$^+$ T cells were quantified by

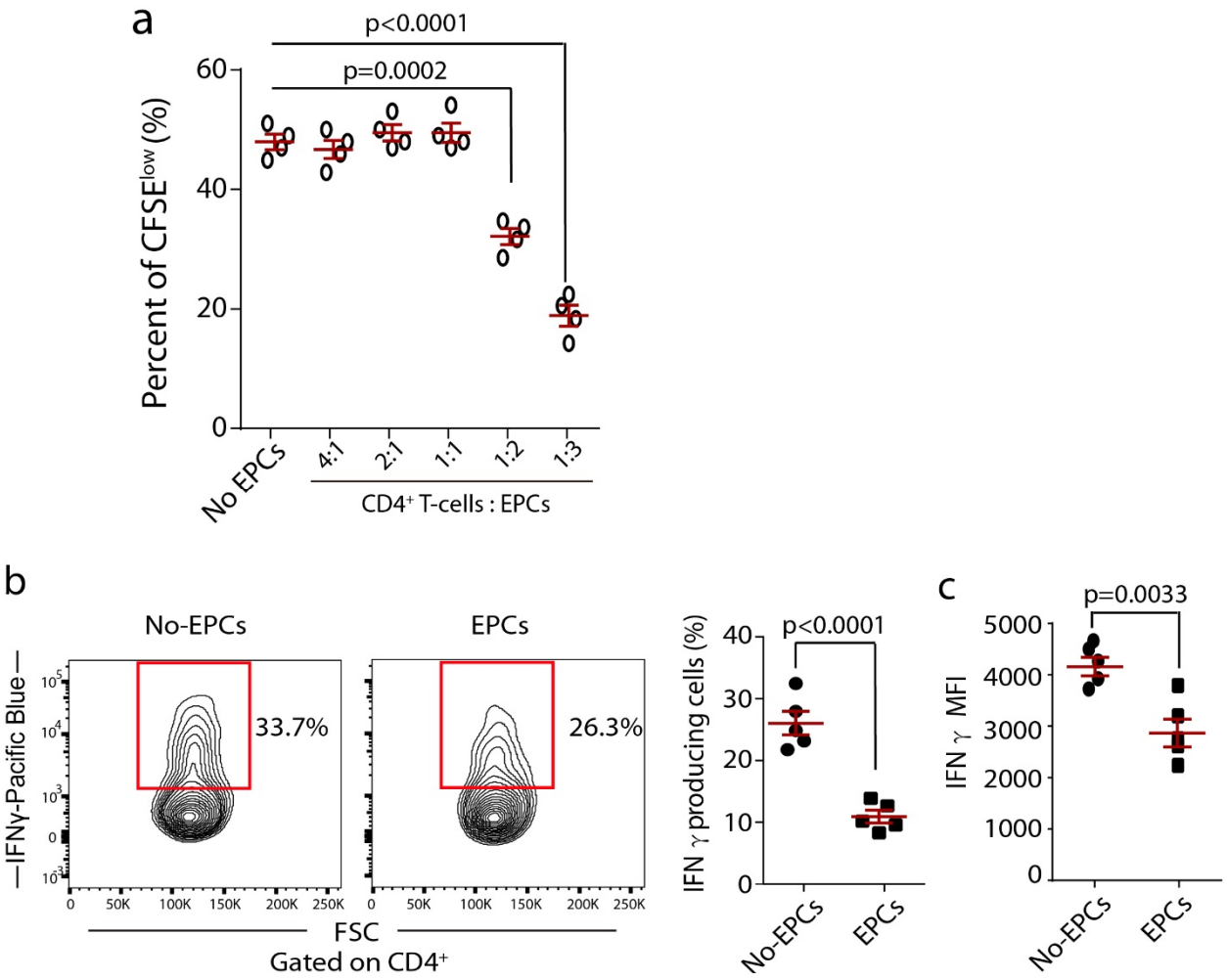
staining for intracellular IFN-γ and GzmB using flow cytometry after stimulating splenocytes with a specific OVA peptide in vitro. **c,** Frequency and absolute number of antigen-specific $CD8^+$ T cells in spleens of tumor-bearing mice. Data are representative of three independent experiments. Two-tailed Student's t-tests were used for all analyses, with the exception of survival curves, for which Gehan-Breslow-Wilcoxon tests were used.



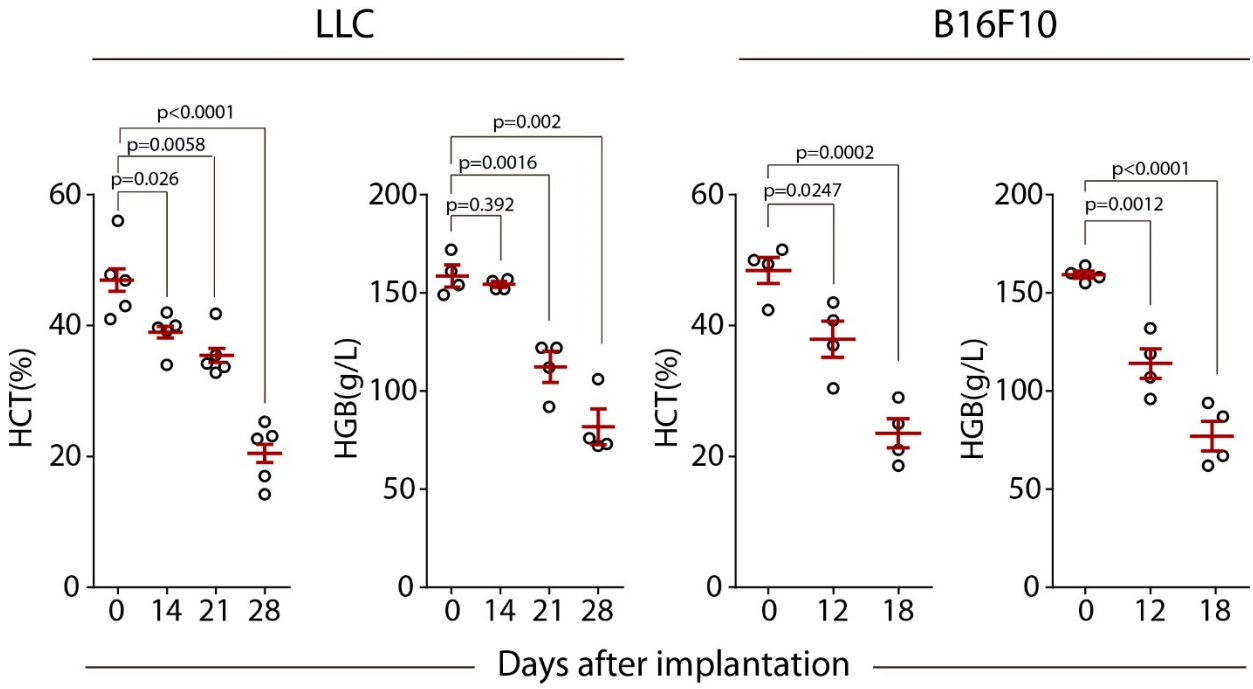
Supplementary Fig. 4. Splenic accumulation of EPCs in tumor-bearing mice. C57BL/6 mice were sacrificed 28 days after LLC cell inoculation, and different cell populations in the spleen were analyzed by flow cytometry. Frequencies of $CD8^+$ T (**a**), $CD4^+$ T (**b**), B cells (**c**), Tregs (**d**) MDSCs ($CD11b^+Gr1^+$, **e**), macrophages ($F4/80^+$, **f**), stromal cells ($CD45^-TER119^-$, **g**), and EPCs ($CD71^+TER119^+$, **h**) are shown. Data are representative of at least three independent experiments.



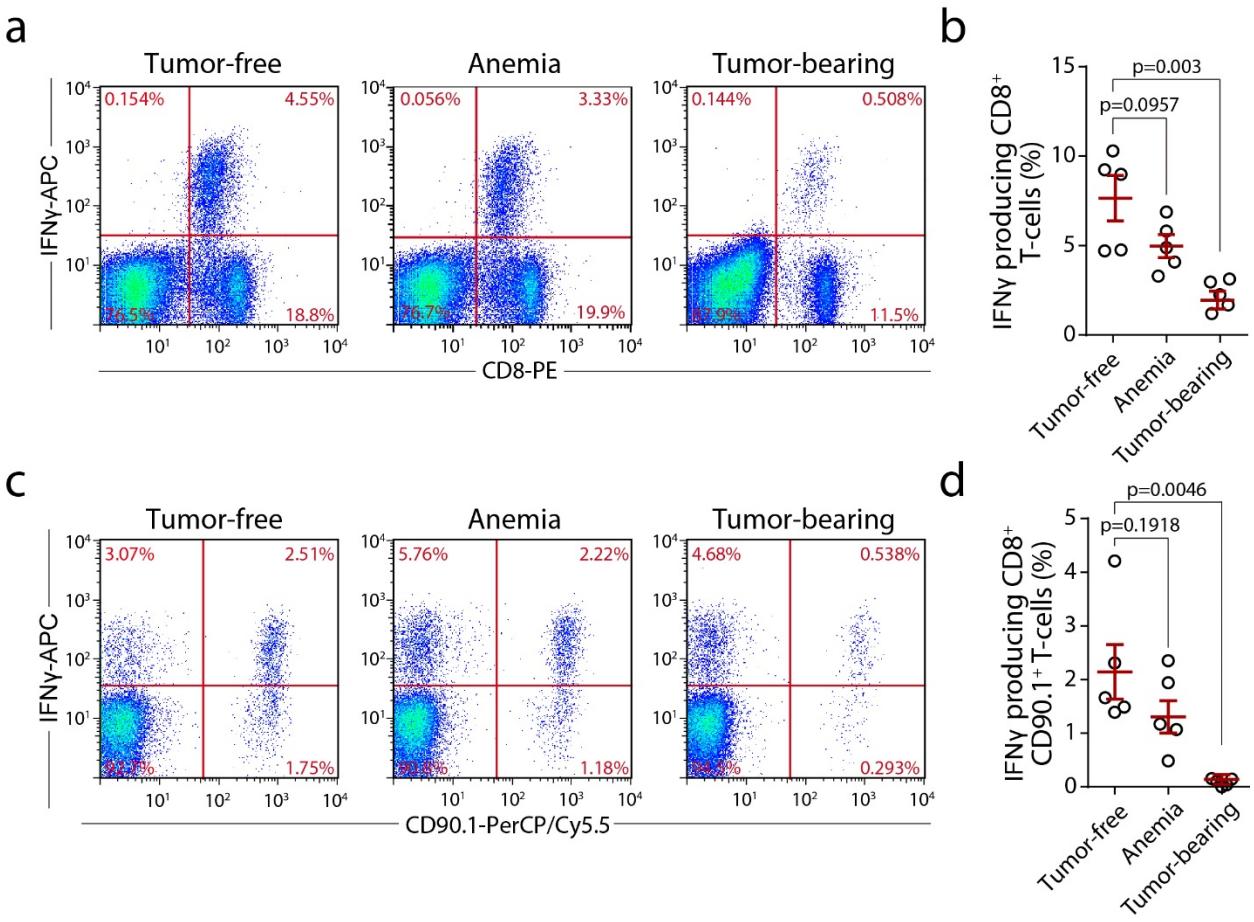
Supplementary Fig. 5. EPC accumulation in tissues of tumor-bearing and anemic mice. a, Representative flow cytometry results showing the frequency of $CD71^{+}TER119^{+}$ cells in different tissues from control (n=5), tumor-bearing (n=5) and anemic (n=5) mice. **b,** Cumulative composite flow cytometry data show the frequency of $CD71^{+}TER119^{+}$ cells in different tissues of tumor-bearing mice at different time points (n=5) after LLC cell inoculation.



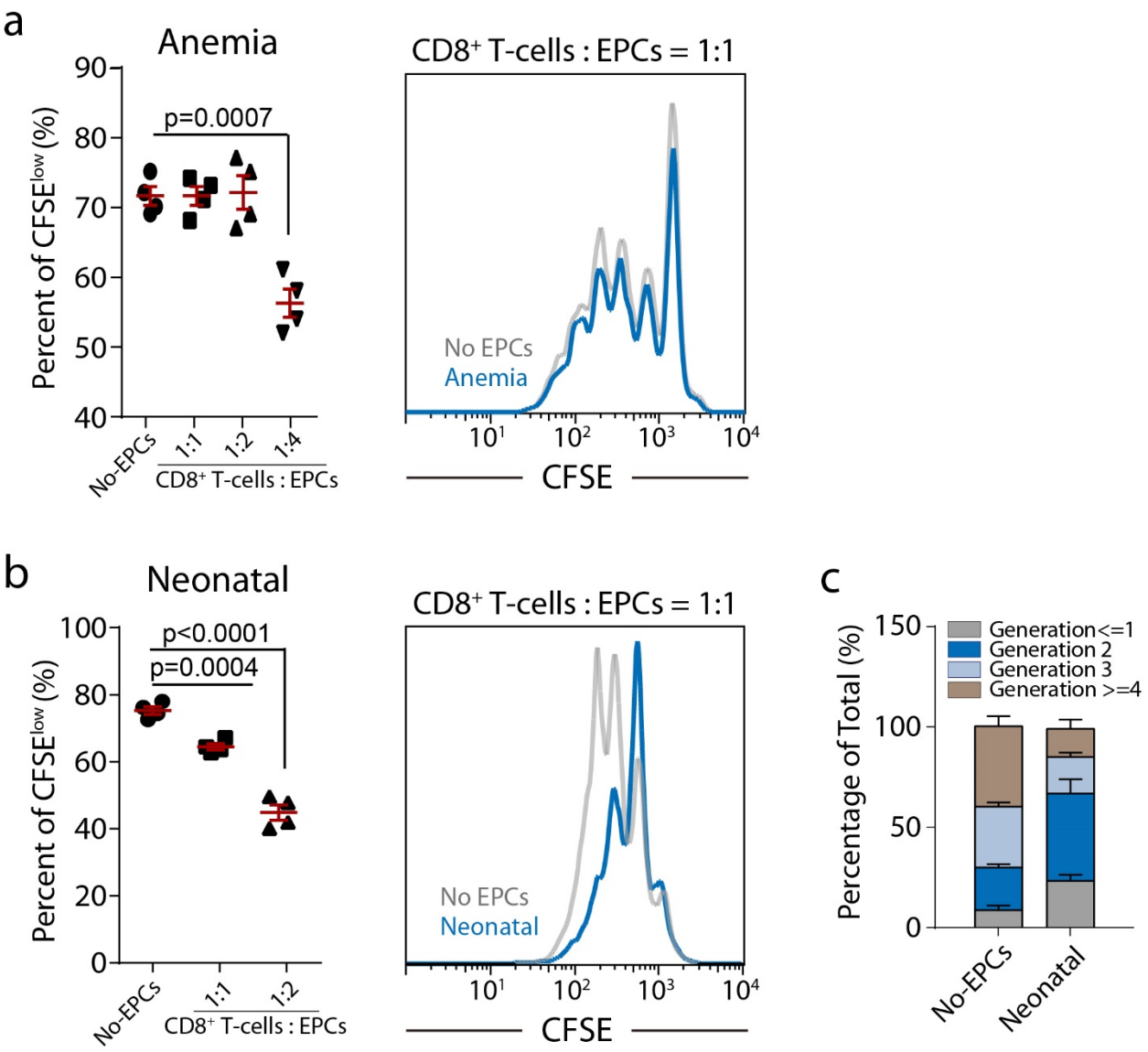
Supplementary Fig. 6. CD71$^+$TER119$^+$ EPCs inhibit CD4$^+$ T cell proliferation and differentiation. a, CD71$^+$TER119$^+$ EPCs isolated from the spleens of tumor-bearing mice were co-cultured with anti-CD3 and anti-CD28 antibodies, and stimulated CFSE-labeled CD4$^+$ T cells at different CD4$^+$ T cell:EPC ratios. Cumulative composite data show the proliferation of CFSE-labeled CD4$^+$ T cells(n=4). **b**, CD4$^+$ T cells purified from wild-type mice were cocultured with CD71$^+$TER119$^+$ cells (CD4$^+$ T cell: EPC ratio 1:2) and stimulated with anti-CD3 and anti-CD28 under TH1 differentiation culture conditions. After 4 days, intracellular IFN-γ expression (gated on CD4) was determined by flow cytometry(n=5). **c**, Cumulative composite data shows the MFI of IFN-γ(n=5). Data are representative of three independent experiments and were analyzed by two-tailed unpaired t-test. Error bars denote the SEM.



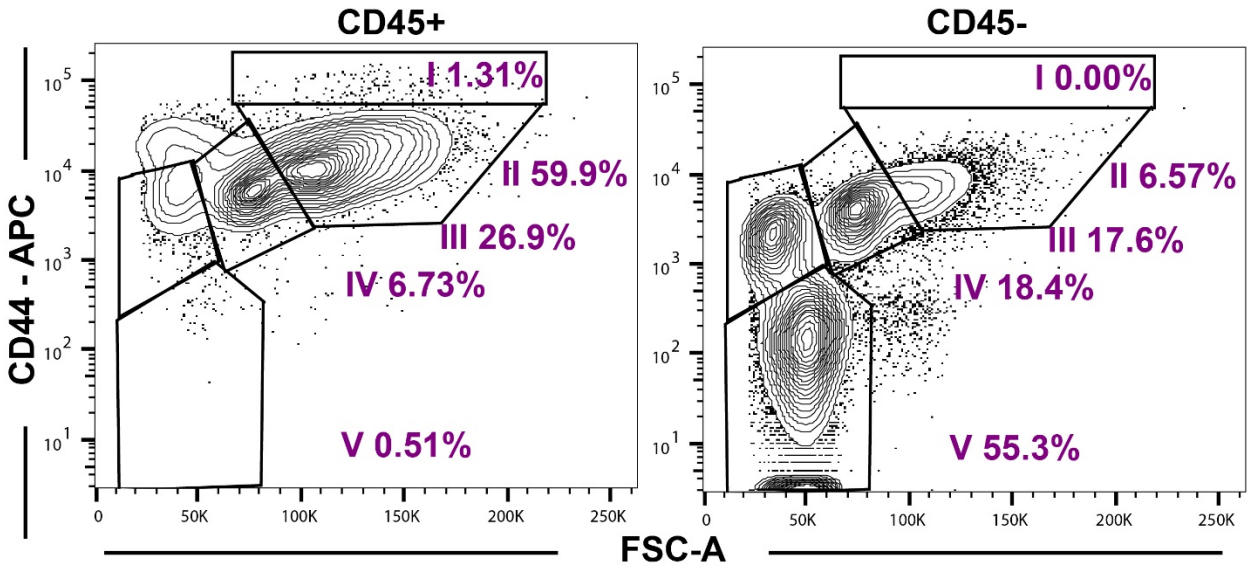
Supplementary Fig. 7. Anemia induced by tumorigenesis. Hematocrit (HCT) and hemoglobin (HGB) were measured in tumor-bearing mice at different time points (n=4 or 5) after LLC or B16F10 inoculation, as indicated. Each point represents data from an individual mouse, and data are representative of at least three independent experiments. Two-tailed Student's t-tests were used for all analyses. Error bars represent the means ± SEM.



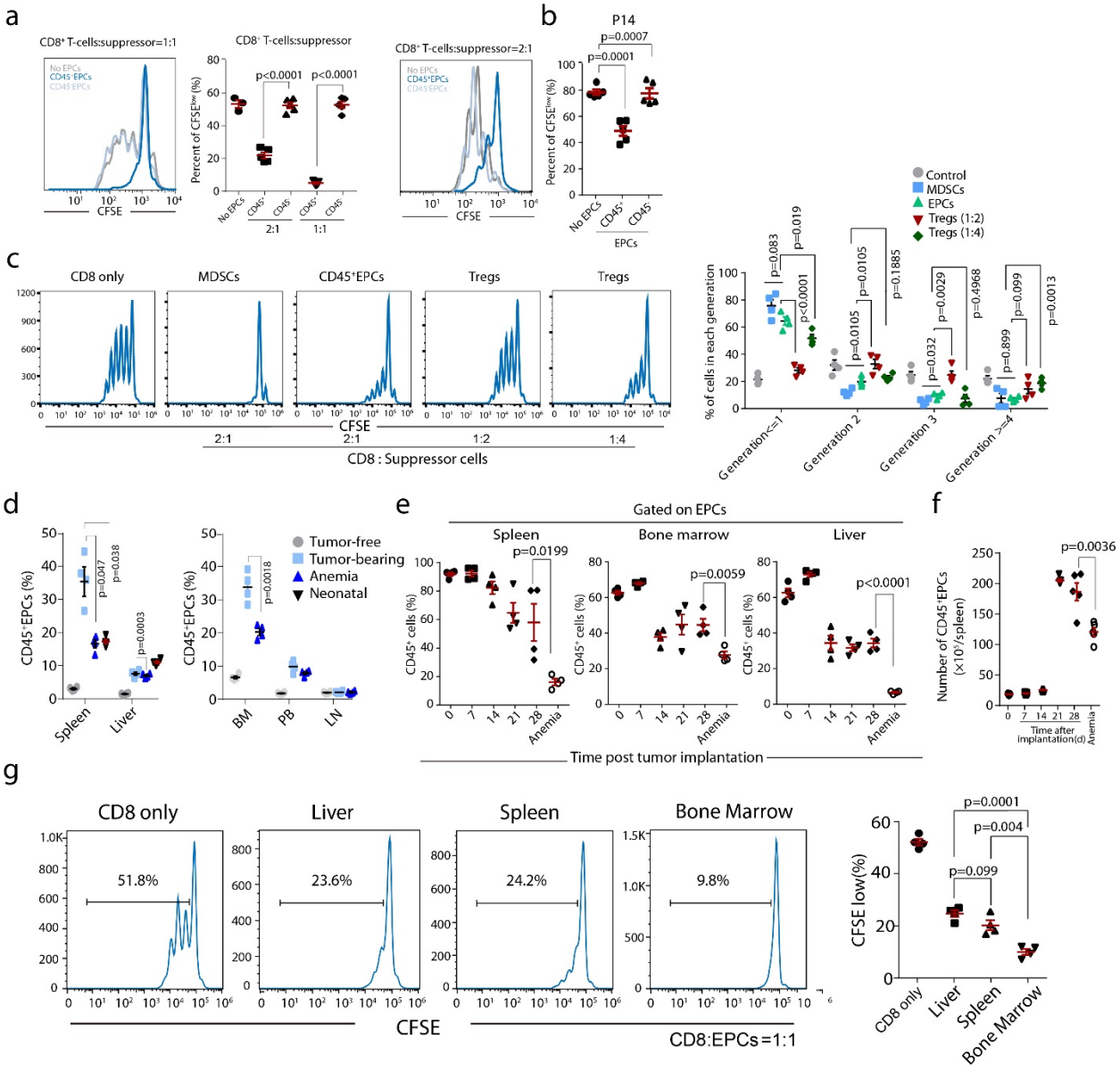
Supplementary Fig. 8. Listeria-specific CD8$^+$ T cell responses remain intact in mice with acute anemia. a-b, Mice with established tumors (21 days after LLC inoculation, n=5), acute anemia (n=5), or healthy control mice (n=5) were infected with △actArLmOVA. Antigen-specific CD8$^+$ T cells were measured by flow cytometric analysis of intracellular IFN-γ in spleen cells on day 7 post infection after stimulating splenocytes with OVA peptide *in vitro*. **c-d,** Mice with established tumors (21 days after LLC inoculation, n=5), acute anemia (n=5) or control healthy mice (n=5) were intravenously injected with equal numbers of CD90.1$^+$CD8$^+$ OT-1 cells. Six hours after OT-1 transfer, mice were infected with Lm. Splenocytes were harvested on day 7 post-infection and stimulated with OVA peptide *in vitro*. IFN-γ-producing CD90.1$^+$CD8$^+$ OT-1 cells were quantified by flow cytometry. Data are representative of at least three independent experiments. Two-tailed Student's t-tests were used for all analyses. Error bars represent the means ± SEM.



Supplementary Fig. 9. Differential suppressive capacity of CD71$^+$TER119$^+$ EPCs isolated from acutely anemic and neonatal mice. a-b, CD71$^+$TER119$^+$ EPCs isolated from the spleens of anemic (a) and neonatal (b) mice were co-cultured at different CD8$^+$T cell:EPC ratios with CFSE-labeled CD8$^+$ T cells that were stimulated with CD3 and CD28 antibodies(n=4). Representative flow cytometry results and cumulative composite data show the proliferation of CFSE-labeled CD8$^+$ T cells. Data are representative of at least three independent experiments. Two-tailed Student's t-tests were used for all analyses. Error bars represent the means ± SEM.

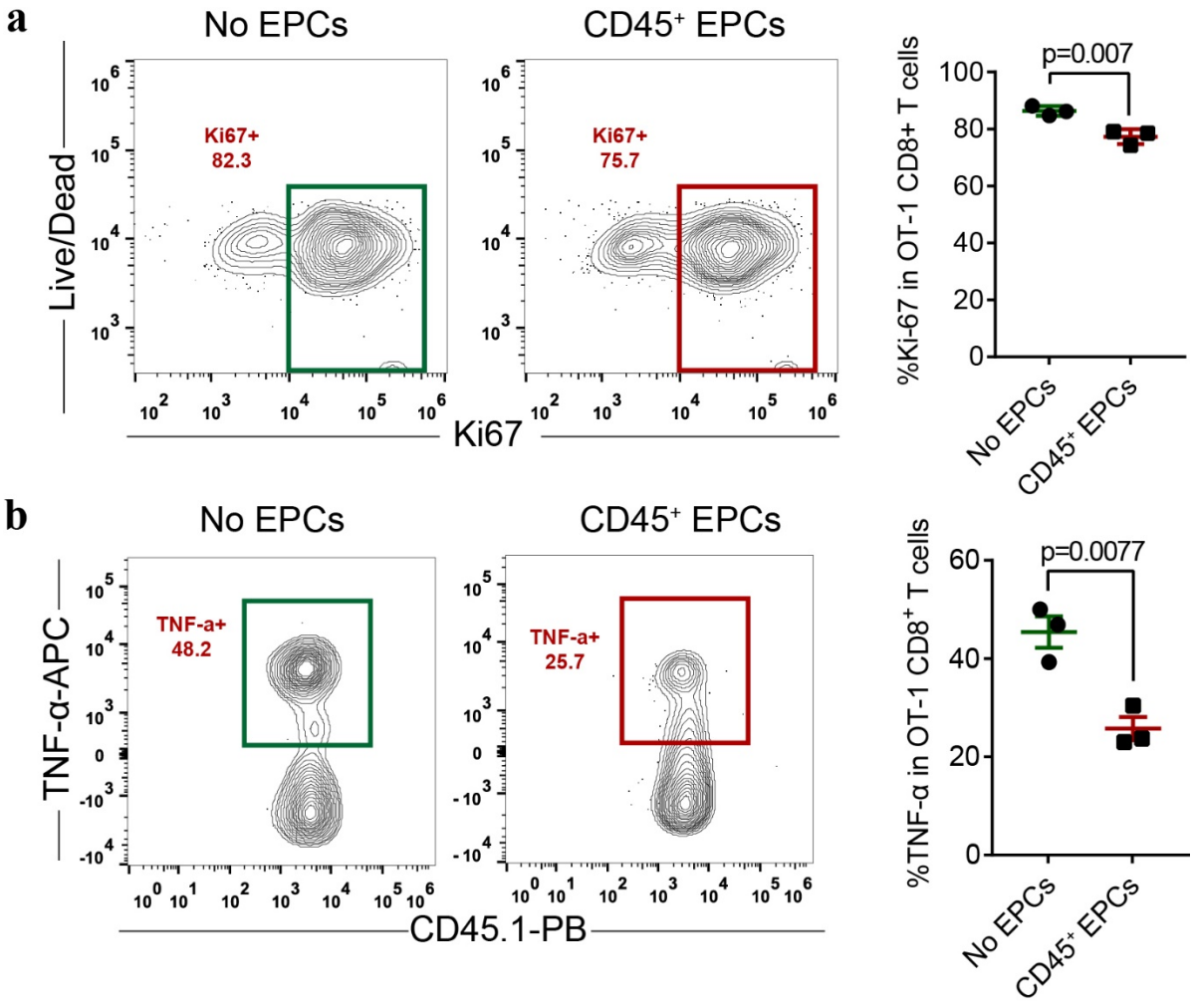


Supplementary Fig. 10. CD45$^+$ EPCs are at the earlier developmental stages than CD45$^-$ ones. 1×10^6 Lewis lung cancer cells (LLCs) were subcutaneously inoculated into C57BL/6 mice to allow for tumor formation. At day 21 post-inoculation, tumor-bearing mice were sacrificed and spleens were analyzed by FACS. Ter119$^+$CD71$^+$ cells were separated as CD45$^+$ and CD45$^-$ subpopulations and plotted as CD44 versus FSC. As defined by Chen et al., the developmental stages of erythroid cells from I (progenitor) to V (fully differentiated red blood cells)[1] were displayed.



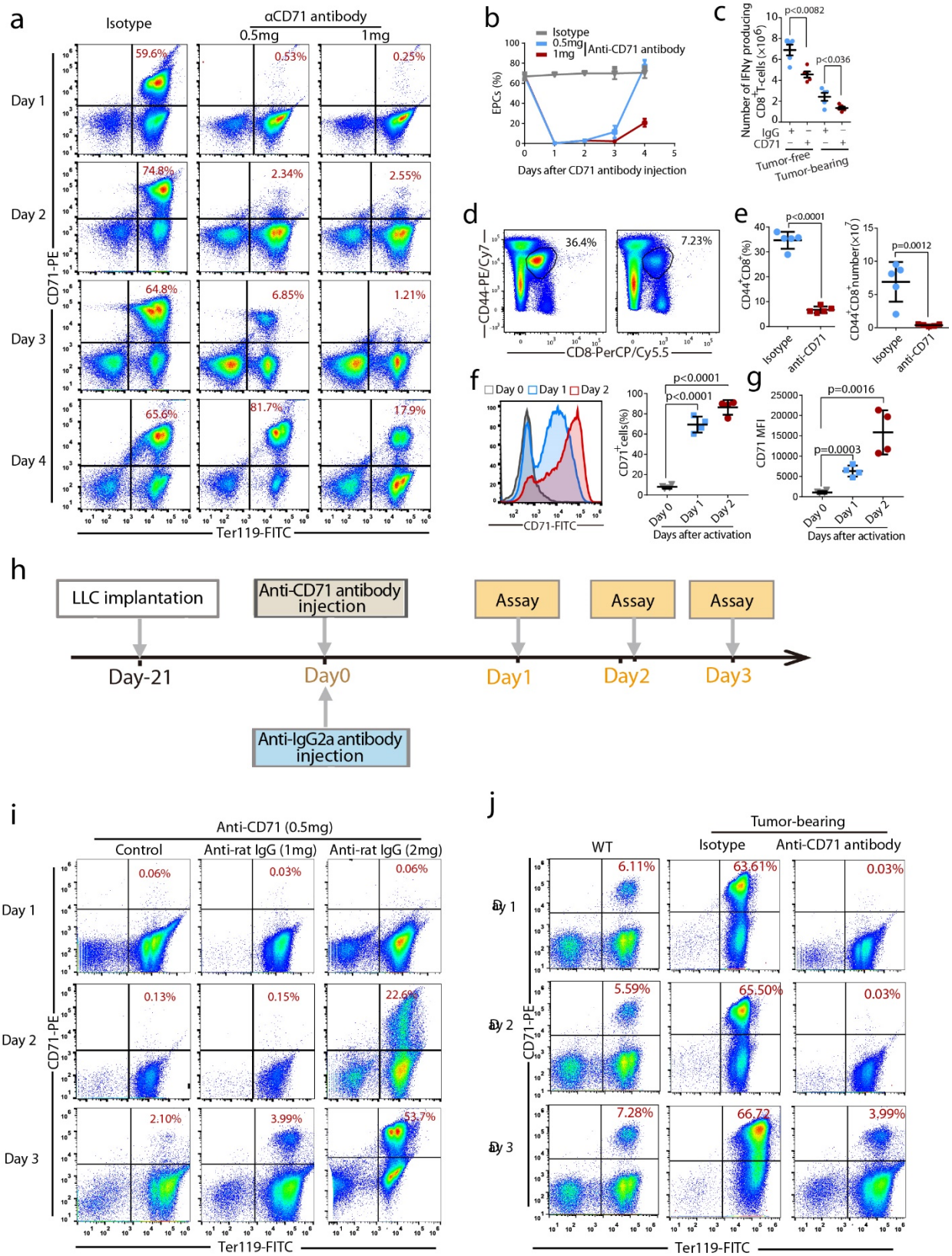
Supplementary Fig. 11. Immunosuppressive CD45$^+$ early EPCs uniquely accumulate in tumor-bearing mice. a, Proliferation of CFSE-labeled CD8$^+$ T cells in response to anti-CD3 and anti-CD28 was analyzed after co-culture with CD45$^+$CD71$^+$TER119$^+$ or CD45$^-$CD71$^+$TER119$^+$ cells isolated from the spleens of tumor-bearing mice at different CD8$^+$ T cell:EPC ratios (n=5). **b,** CD45$^+$CD71$^+$TER119$^+$ and CD45$^-$CD71$^+$TER119$^+$ EPCs isolated from the spleens of tumor-bearing mice were co-cultured with CFSE-labeled P14 splenic cells, which were stimulated with a specific peptide, at a ratio of 2:1 (P14 cells:EPCs). Proliferation of CFSE-labeled CD8$^+$ T cells (gated on CD8$^+$ P14 cells) was then analyzed (n=5). **c,** Proliferative capacity of CFSE-labeled CD8$^+$ T cells in response to anti-CD3 and anti-CD28 was analyzed after co-culture with CD45$^+$CD71$^+$TER119$^+$ EPCs, MDSCs or Tregs isolated from the spleen of tumor-bearing mice (day 21) at CD8$^+$ T cell:suppressor cell ratios as indicated in the figure(n=4). Two-tailed unpaired t-test of three independent experiments was performed by measuring the distribution of CD8$^+$ T cells in each division. **d,** Frequency of CD45$^+$CD71$^+$TER119$^+$ cells in spleen (SPL),

peripheral blood (PB), bone marrow (BM), lymph node (LN) and liver (HEP) for control, tumor-bearing, neonatal and anemic mice (n=4). **e,** Cumulative composite flow cytometry data show the frequencies of $CD45^+$ cells within the $CD71^+TER119^+$ cell population in different tissues of anemic and tumor-bearing mice at the indicated times (n=4) after LLC inoculation. **f,** Cumulative composite data show the total number of $CD45^+CD71^+TER119^+$ cells in the spleens of tumor-bearing and anemic mice(n=5). **g,** Proliferative capacity of CFSE-labeled $CD8^+$ T cells in response to anti-CD3 and anti-CD28 antibody stimulation was analyzed after co-culture with $CD45^+CD71^+TER119^+$ EPCs isolated from spleens of healthy control or tumor-bearing mice (n=5) at days 21 and 28 ($CD8^+$ T cell:EPC ratio of 2:1). Data are representative of at least three independent experiments. Two-tailed Student's t-tests were used for all analyses. Error bars represent the means ± SEM.

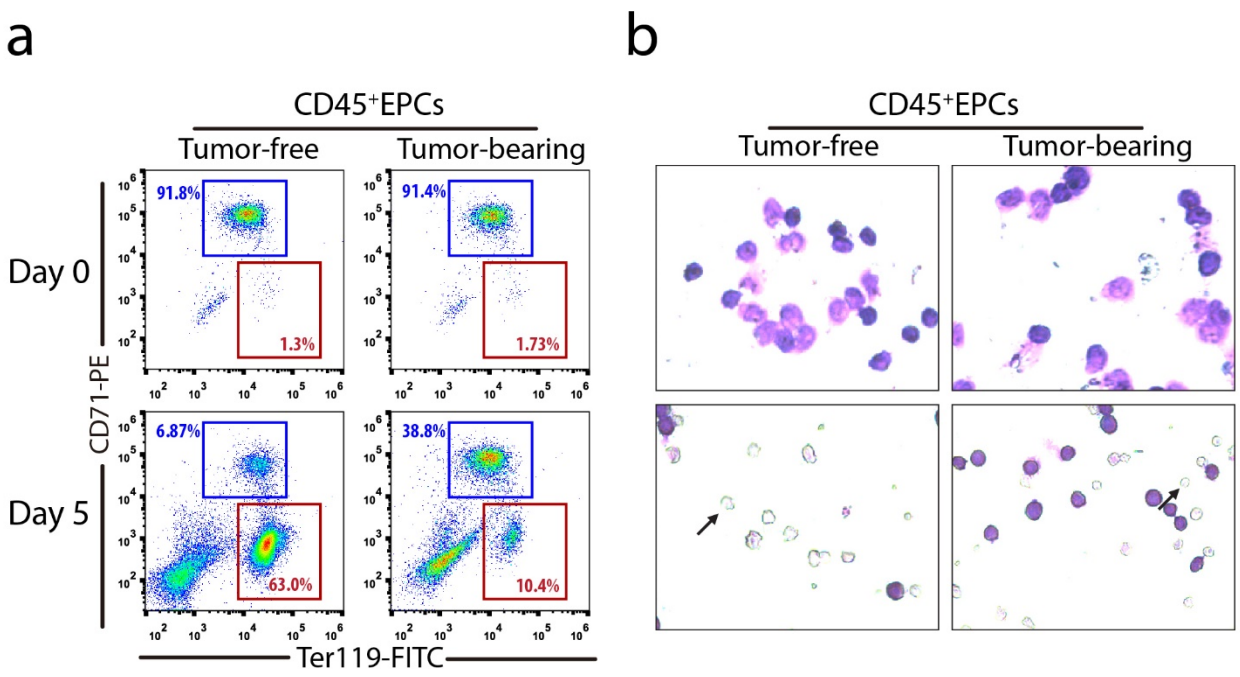


Supplementary Fig. 12. $CD45^+$ EPCs suppress tumor-specific CTL responses *in vivo*. A total of 2×10^5 B16-OVA melanoma cells were subcutaneously transplanted into $CD45.2^+$ C57BL/6 mice. At day 10 post tumor inoculation, mice were intravenously injected with 2×10^5 $CD45.1^+CD8^+$ OT-I cell mixed with either PBS or 2×10^6 $CD45^+$ EPCs purified from other tumor-bearing mice. Mice were sacrificed at day 5 after OT-I transfer and splenocytes were

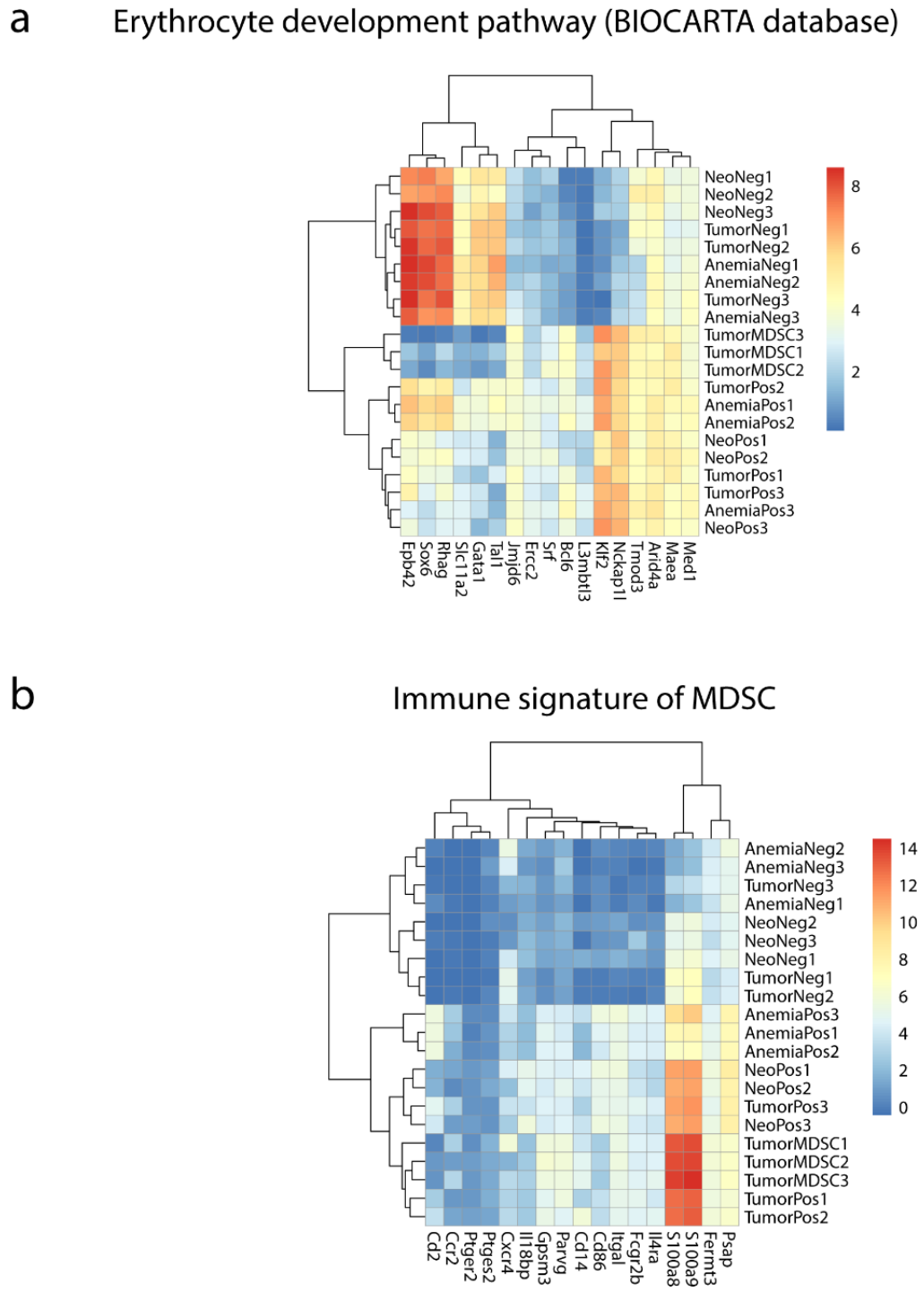
isolated and restimulated with $OVA_{257-264}$ peptide for 5 hours. The proliferative capacity of transferred OT-I cells was assessed by Ki67 staining (**a**) and their cytotoxicity was measured by intracellular TNF-α staining (**b**). Representative flow cytometry data (**left**) and the statistical analysis of mean frequencies (**right**) are presented. Data are collected from three mice (n=3). Two-tailed Student's t-tests were used for all analyses.


a
Isotype
αCD71 antibody
0.5mg
1mg
Day 1
Day 2
Day 3
Day 4
59.6%
0.53%
0.25%
74.8%
2.34%
2.55%
64.8%
6.85%
1.21%
65.6%
81.7%
17.9%
CD71-PE
Ter119-FITC
b
Isotype
0.5mg
1mg
Anti-CD71 antibody
EPCs (%)
Days after CD71 antibody injection
c
p<0.0082
p<0.036
Number of IFNγ producing CD8+T-cells (×10^6)
IgG
CD71
Tumor-free
Tumor-bearing
d
36.4%
7.23%
CD44-PE/Cy7
CD8-PerCP/Cy5.5
e
p<0.0001
p=0.0012
CD44+CD8+(%)
CD44+CD8+number(×10^7)
Isotype
anti-CD71
f
Day 0
Day 1
Day 2
CD71-FITC
p<0.0001
p<0.0001
CD71+cells(%)
Days after activation
g
p=0.0016
p=0.0003
CD71 MFI
Days after activation
h
LLC implantation
Anti-CD71 antibody injection
Assay
Assay
Assay
Day-21
Day0
Day1
Day2
Day3
Anti-IgG2a antibody injection
i
Anti-CD71 (0.5mg)
Control
Anti-rat IgG (1mg)
Anti-rat IgG (2mg)
Day 1
Day 2
Day 3
0.06%
0.03%
0.06%
0.13%
0.15%
22.6%
2.10%
3.99%
53.7%
CD71-PE
Ter119-FITC
j
Tumor-bearing
WT
Isotype
Anti-CD71 antibody
Day 1
Day 2
Day 3
6.11%
63.61%
0.03%
5.59%
65.50%
0.03%
7.28%
66.72
3.99%
CD71-PE
Ter119-FITC

Supplementary Fig. 13. Specific depletion of $CD71^+$ EPCs. 1×10^6 LLC cells were subcutaneously injected into C57BL/6 mice at day 0 and different doses of anti-CD71 deletion antibody was injected intravenously at day 21 after tumor cell inoculation (IgG was used as control). Frequencies of $CD71^+TER119^+$ cells in peripheral blood were detected by flow cytometry at different days after antibody administration. Representative flow cytometry **(a)** and cumulative composite data (**b**) show the frequency of $CD71^+TER119^+$ cells in peripheral blood. Mice were infected with LCMV at day 21 following LLC inoculation and anti-CD71 deletion antibody or control IgG was injected intravenously at days 21 and 24 after LLC inoculation. Mice were sacrificed on day 8 post-LCMV infection. Cumulative composite data show the number of $CD8^+IFN\gamma^+$ cells in spleen(n=5) **(c)**. C57BL/6 mice infected with LCMV were intravenously injected with anti-CD71 deletion antibody or control IgG on days 0 and 4 after LCMV infection. Mice were sacrificed on day 8 post-LCMV infection(n=5). Representative flow cytometry **(d)** and cumulative composite data **(e,** n=5**)** show the frequency and number of $CD8^+CD44^+$ cells in spleen. $CD8^+$ T cells were isolated and cultured in vitro in the presence of anti-CD3 and anti-CD28. The frequency of $CD71^+$ cells among $CD8^+CD44^+$T cells was detected by flow cytometry at the indicates days after entering culture. Representative flow cytometry and cumulative composite data **(f,** n=4**)** are shown. CD71 MFI of $CD8^+CD44^+$T cells was analyzed **(g,** n=4**)**. 1×10^6 LLC cells were subcutaneously injected into C57BL/6 mice (PBS was used as control). Anti-CD71 deletion antibody or control IgG was intravenously injected at day 21 after tumor cell inoculation. To attenuate the anti-CD71 deletion antibody, different doses of anti-IgG2a antibody were intravenously injected at the same time **(h)**. The frequency of $CD71^+TER119^+$ cells in peripheral blood was detected by flow cytometry at the indicated times after antibody administration **(i)**. 1×10^6 LLC cells were subcutaneously injected into C57BL/6 mice (PBS was used as control). Anti-CD71 deletion antibody (1 mg/mouse) was intravenously injected at day 21 after tumor cell inoculation (IgG was used as control, 1 mg/mouse). To attenuate the anti-CD71 deletion antibody, anti-IgG2a antibody (3 mg/mouse) was intravenously injected 12h later. Then, we adoptively transferred P14 $CD8^+$ T cells (CD90.1, 2×10^6 cells/mouse) and infected mice with LCMV cl13 simultaneously 12 h after administration of anti-IgG2a antibody. All mice were sacrificed on day 2 after LCMV infection**(j)**. Representative flow cytometry data shows deletion efficiency of the anti-CD71 antibody **(k)**.



Supplementary Fig. 14. $CD45^+CD71^+TER119^+$ EPCs differentiate into mature RBCs. $CD45^+CD71^+TER119^+$ EPCs were isolated by flow cytometry from tumor-bearing or healthy control mice and cultured in vitro under conditions that promote erythroid differentiation. Representative flow cytometry **(a)** and morphology **(b)** data**.** Giemsa staining shows erythroid differentiation at days 0 and 5 of culture **(b)**.



Supplementary Fig. 15. Transcriptome signatures to characterize EPC physiological and pathological origins. To categorize the differentiation and functional potential of EPCs, signature gene panels for erythroid differentiation **(a)** and MDSC function **(b)** were extracted from the RNAseq data set (Fig. 3a-b). Unsupervised clustering was performed on splenic $CD45^{+}$ and $CD45^{-}$ EPCs purified from neonatal, acutely anemic and tumor-bearing mice. MDSCs purified from spleens of tumor-bearing mice are included as a reference.

Supplementary Tables

Supplementary Table 1. Clinical information for the 167 cancer patients with different types of malignant tumors used in the EBV infection study (Fig. 4e-g).

No.	ID	Age	Gender	Diagnosis	Hb (g/L)	EBV (copies/ml)	Stage
1	07895013	46	M	Nasopharyngeal carcinoma	176	851	III
2	07195985	68	M	Small cell lung cancer	110	<400	Limited
3	07825720	77	F	Breast cancer	101	643	III
4	05337039	62	F	Small cell lung cancer	96	<400	Limited
5	05337039	52	M	Small cell lung cancer	66	6300	Limited
6	05991279	60	F	Breast cancer	116	<400	III
7	06003668	60	M	Non-small cell lung cancer	94	434	III
8	00969251	62	M	Lung adenocarcinoma	130	<400	rIV
9	07648115	52	F	Rectum cancer	126	<400	rIV
10	05732953	66	M	Primary bronchogenic lung squamous cell carcinoma	71	603	III
11	06055174	16	F	Breast cancer	107	500	III
12	05895075	13	M	Pinaeal tumor	113	<400	III
13	06034647	40	F	Breast cancer	147	<400	IV
14	05690867	59	F	Breast cancer	96	463	rIV
15	07659165	61	M	Esophageal squamous cell cancer	107	411	III
16	07853447	73	M	Nasopharyngeal squamous cell cancer	132	<400	IV
17	07062881	62	M	Colon cancer	115	<400	III
18	07535817	41	F	Colon cancer	110	<400	III
19	03415090	61	F	Breast cancer	102	<400	rIV
20	07198192	69	M	Laryngeal squamous cell cancer	127	776	III
21	04980245	54	M	Lung squamous cell carcinoma	135	800	IIIA
22	07843380	59	F	Esophageal squamous cell cancer	115	<400	III
23	04940642	50	M	Nasopharyngeal squamous cell cancer	82	<400	III
24	07821594	60	F	Cervical squamous cell carcinoma	99	615	III
25	07894165	58	F	Rectal caner	133	<400	IV
26	05903285	36	F	Ovarian cancer	129	<400	III
27	05679620	64	M	Lung squamous cell carcinoma	104	410	IIIb
28	07867140	71	F	Cardia adenocarcinoma	113	550	III
29	05153701	42	F	Lung adenocarcinoma	108	<400	IV
30	07811161	41	M	Nasopharyngeal squamous cell	110	496	IV
31	05612175	62	M	Tongue cancer	103	420	IV
32	04929706	59	F	Primary bronchial adenocarcinoma of the lung	113	<400	IV
33	07855681	33	M	Primary bronchial adenocarcinoma of the lung	123	<400	III
34	07680469	67	M	Tongue cancer	137	<400	III
35	07895124	64	M	Lung cancer	66	4370	III
36	06005611	24	M	Tongue squamous cell carcinoma	120	<400	III
37	07759139	39	M	Nasopharyngeal squamous cell	123	<400	IIIA
38	07903245		M	Colon cancer	128	<400	IV

39	07847305	74	M	Primary bronchial small cell lung cancer	103	1170	IIIB
40	07638833	58	M	Colon cancer	110	<400	III
41	07837029	47	M	Primary bronchogenic lung squamous cell carcinoma	116	<400	III
42	07900061	14	F	Small cell lung cancer	132	1000	Extensive
43	07579757	58	M	Small cell lung cancer	112	<400	Limited
44	05752348	56	F	Cervical squamous cell carcinoma	132	790	III
45	03949479	44	M	Pelvic malignancy	109	<400	IV
46	07703736	65	F	Cervical squamous cell carcinoma	97	<400	IV
47	07897540	48	F	Cervical squamous cell carcinoma	97	<400	IV
48	07709368	58	M	Non-small cell lung cancer	73	548	IV
49	02410882	39	F	Breast cancer	119	<400	III
50	05405434	73	F	Non-Hodgkin's lymphoma	112	584	IV
51	05753621	72	M	Small cell lung cancer	123	496	Extensive
52	07846143	40	F	Nasopharyngeal squamous cell	111	424	III
53	07613054	63	M	Non-small cell lung cancer	84	7910	rIV
54	03221140	66	M	Carcinoma of urinary bladder	132	2330	IV
55	04627935	53	M	Lung cancer	146	<400	IV
56	07659113	55	M	Non-small cell lung cancer	98	6880	IV
57	03533316	62	F	Non-small cell lung cancer	128	<400	III
58	07846569	63	M	Non-small cell lung cancer	108	<400	III
59	07839120	49	M	Non-small cell lung cancer	139	<400	IV
60	05520961	69	M	Prostatic cancer	140	458	IV
61	07612103	53	M	Small cell lung cancer	143	<400	Extensive
62	07063014	49	M	Nasopharyngeal squamous cell	133	<400	III
63	07896361	76	F	Metastasis squamous cell	113	790	III
64	07443529	29	M	Rectum cancer	125	<400	IV
65	05971281	52	M	Small cell lung cancer	85	<400	Extensive
66	07567916	60	M	Nasopharyngeal squamous cell	122	690	III
67	07828686	70	F	Breast cancer	149	1400	III
68	05792179	38	M	Laryngo carcinoma	108	<400	III
69	05916328	50	F	Breast cancer	92	<400	rIV
70	07895276	60	F	Esophageal squamous cell cancer	132	<400	III
71	05734011	49	M	Laryngo carcinoma	126	1180	III
72	07793060	53	M	Non-small cell lung cancer	129	<400	IV
73	07895366	53	M	Nasopharyngeal squamous cell	109	1210	III
74	07140879	48	M	Non-small cell lung cancer	112	<400	IV
75	07442213	52	M	Rectum cancer	135	<400	IIb
76	68103580	38	F	Breast cancer	118	<400	IIIA
77	07321276	52	M	Multiple myeloma	147	<400	III
78	05124803	50	F	Non-small cell lung cancer	127	497	IV
79	06059938	72	M	Non-Hodgkin's lymphoma	137	1600	III
80	07888019	70	M	Nasopharyngeal squamous cell	77	8400	IV
81	06051555	63	M	Non-small cell lung cancer	130	<400	III
82	07841848	55	M	Small cell lung cancer	143	<400	Extensive
83	05105660	72	M	Rectum cancer	125	1540	rIV
84	07820551	67	M	Non-Hodgkin's lymphoma	74	1150	III
85	07575124	60	F	Non-small cell lung cancer	107	<400	rIV

86	07724974	30	F	Carcinoma of submaxilary gland	98	1540	III
87	04650882	37	M	Nasopharyngeal squamous cell	142	<400	III
88	05920670	51	M	Laryngo carcinoma	138	<400	III
89	06053980	66	M	Rectum cancer	118	1800	IV
90	07185514	64	F	Breast cancer	96	1130	IV
91	07647544	29	M	Osteoblastoma	134	<400	III
92	07632546	42	M	Nasopharyngeal squamous cell	141	408	IV
93	02651458	67	M	Esophageal squamous cell cancer	88	<400	III
94	06069054	34	M	Tongue cancer	89	928	III
95	07880370	57	M	Non-small cell lung cancer	144	730	IV
96	05989028	49	M	Esophageal squamous cell cancer	136	<400	III
97	07860785	53	M	Nasopharyngeal squamous cell	119	<400	III
98	07890643	49	M	Nasopharyngeal squamous cell	150	<400	III
99	07774183	43	F	Cervical cancer	87	1080	IV
100	07044368	70	F	Melanoma	94	803	rIV
101	05920081	81	F	Ovarian cancer	112	6410	IIIb
102	07869420	49	M	Nasopharyngeal squamous cell	113	1490	IV
103	04366533	29	F	Breast cancer	103	<400	III
104	07856083	68	M	Laryngo carcinoma	107	<400	III
105	04801797	65	M	Esophageal squamous cell cancer	98	<400	III
106	07343965	51	M	Renal carcinoma	96	<400	rIV
107	07730104	52	F	Ovarian cancer	88	<400	IIIb
108	07181329	60	M	Non-small cell lung cancer	96	<400	IV
109	05688509	68	F	Non-small cell lung cancer	135	780	IV
110	07207312	41	M	Small cell lung cancer	133	<400	Extensive
111	07815225	65	M	Non-small cell lung	80	1920	IV
112	05689100	78	F	Non-small cell lung cancer	93	910	IIIA
113	07810012	64	M	Non-small cell lung cancer	126	<400	IV
114	05935348	60	M	Non-small cell lung cancer	77	930	IV
115	04023326	78	F	Hepatocellular carcinoma	97	2280	IV
116	07379305	50	M	Non-small cell lung cancer	133	<400	IV
117	07903046	52	F	Thyroid carcinoma	136	<400	II
118	07832602	48	F	Non-small cell lung cancer	112	<400	IV
119	70009677	52	M	Sinus cancer	124	<400	IV
120	07257155	50	F	Ovarian cancer	102	<400	IV
121	07645628	8	M	Glioma	138	620	III
122	07764784	59	M	Non-Hodgkin's lymphoma	83	<400	III
123	04997009	58	M	Rectum carcinoma	123	410	rIV
124	07486030	63	M	Non-small cell lung cancer	129	876	III
125	07461780	56	M	Non-small cell lung cancer	123	600	IV
126	07811295	64	M	Non-small cell lung cancer	104	2000	IV
127	07837308	52	M	Non-small cell lung	142	<400	III
128	07609270	10	F	Intracranial germinomas	85	<400	rIII
129	07778200	51	M	Esophageal squamous cell cancer	95	<400	III
130	07316014	55	M	Small cell lung cancer	89	<400	Extensive
131	07502501	49	F	Cholangiocellular carcinoma;	95	799	rIV
132	07895716	53	M	Non-small cell lung cancer	145	<400	IV
133	07830955	75	F	Peritoneal carcinoma	82	3490	III
134	07895402	52	M	Nasopharyngeal squamous cell	140	520	IV

135	03320072	62	M	Non-small cell lung cancer	121	458	rIV
136	07577962	56	M	Non-small cell lung cancer	132	554	IIIb
137	02888053	72	M	Non-small cell lung cancer	91	<400	III
138	07903283	69	M	Tongue cancer	137	502	III
139	07846087	66	F	Esophageal squamous cell cancer	110	3010	III
140	07896281	56	F	Non-small cell lung cancer	111	<400	III
141	04228779	63	F	Nasopharyngeal squamous cell	126	1440	III
142	0160065	64	M	Nasopharyngeal squamous cell	117	1070	rIV
143	07899027	63	M	Non-small cell lung cancer	112	<400	IV
144	04462246	34	M	Nasopharyngeal squamous cell	102	<400	IV
145	05862096	48	F	Non-small cell lung cancer	85	<400	IV
146	07498447	58	M	Non-small cell lung cancer	79	932	IV
147	06029263	43	M	Non-small cell lung cancer	72	4300	III
148	07221093	64	M	Rectum cancer	55	935	IV
149	05679611	47	M	Nasopharyngeal squamous cell	85	7710	III
150	07911662	71	F	Rectum cancer	77	752	III
151	07483019	64	M	Rectum cancer	65	<400	III
152	07888019	70	M	Nasopharyngeal squamous cell	62	4020	III
153	07316014	55	M	Non-small cell lung	54	<400	IIIB
154	07585360	72	F	Esophageal squamous cell cancer	68	693	III
155	06038755	70	M	Non-small cell lung cancer	62	593	IV
156	04801797	65	M	Esophageal squamous cell cancer	76	<400	IV
157	06017371	46	F	Breast cancer	65	<400	III
158	06202415	51	M	Non-small cell lung cancer	51	730	IV
159	00031631	59	M	Esophageal squamous cell cancer	62	1710	III
160	03912538	54	M	Non-small cell lung cancer	65	1630	III
161	08221390	54	F	Cervical carcinoma	67	1440	IV
162	00237414	53	M	Esophageal squamous cell cancer	71	1060	IV
163	07418835	62	M	Non-small cell lung cancer	74	3120	III
164	08229641	78	F	Rectum cancer	74	5050	IV
165	04676514	66	F	Non-small cell lung	77	9100	III
166	05984900	60	M	Non-small cell lung cancer	78	<400	III
167	05700972	51	M	Hepatocellular carcinoma	57	11500	IV

Supplementary Table 2. Clinical information for the 5 healthy donor and 41 patients with different types of malignant tumors used to study EPC frequency in peripheral blood (Fig. 4e-g and i).

No	ID	Age	Gender	Diagnosis	Hb(g/L)	Stage
1	07612059	46	F	Nasopharyngeal carcinoma	53	III
1	07612059	46	F	Nasopharyngeal carcinoma	53	III
2	07408347	58	M	Diffuse large B-cell lymphoma	63	III
3	05108828	57	F	Pleomorphic liposarcoma of the peritoneum	67	III
4	05994934	64	M	Primary bronchogenic lung cancer	74	IV
5	07337183	69	M	Lung squamous cell carcinoma	77	IV
6	07708983	20	F	Mediastinal malignant germ cell tumors	78	III
7	07737176	61	M	Lung sarcomatoid carcinoma	81	III
8	07622038	27	F	Tonsillar lymphoma	85	III
9	07531718	48	F	Primary bronchogenic lung cancer	88	III
10	07673672	69	M	Diffuse large B-cell lymphoma	88	III
11	05152855	64	F	Primary bronchial adenocarcinoma of the lung	88	IV
12	07277665	46	F	Primary bronchogenic lung squamous cell carcinoma	89	III
13	07468522	68	F	Diffuse large B-cell lymphoma	89	III
14	05310357	71	M	Lung adenocarcinoma	90	III
15	01201637	70	F	Lung squamous cell carcinoma	92	IV
16	05908951	53	M	Left breast infiltrating ductal carcinoma	93	IV
17	05992241	34	M	Gastric adenocarcinoma	95	IV
18	07219424	52	M	Lung adenocarcinoma	98	III
19	07658793	55	F	Gallbladder cancer	98	III
20	07701980	79	F	Lung adenocarcinoma	109	III
21	05991279	52	M	Primary bronchial small cell lung cancer	107	III
22	05689100	32	F	Primary bronchial adenocarcinoma of the lung	105	IV
23	05898617	66	F	Primary bronchial adenocarcinoma of the lung	99	III
24	00945960	64	F	Tongue squamous cell carcinoma	93	III
25	05905574	42	F	Nasopharyngeal squamous cell	100	III
26	07672747	46	M	Colon cancer	109	IV
27	07564619	63	M	Primary bronchial small cell lung cancer	108	III
28	07215539	75	M	Non-Hodgkin's lymphoma	105	III
29	07626046	58	M	Primary bronchogenic lung squamous cell carcinoma	103	III
30	07623835	60	F	Small cell lung cancer	110	IV
31	07679195	36	M	Pelvic malignancy	150	IV
32	07500671	52	F	Cervical squamous cell carcinoma	139	IIIB
33	06008744	59	F	Cervical squamous cell carcinoma	138	IIIB
34	07497250	65	F	Primary bronchogenic lung squamous cell carcinoma	126	III
35	07188428	49	M	Duodenal adenocarcinoma	136	III
36	07535269	69	M	Hodgkin 's lymphoma	127	III
37	04083507	70	M	Left breast infiltrating ductal carcinoma	133	III
38	05724108	49	F	Primary bronchial adenocarcinoma of the lung	117	IV
39	07547089	54	F	Nasopharyngeal squamous cell	119	IV
40	07273674	74	M	Small cell lung cancer	132	III

41	07587762	55	F	Small cell lung cancer	125	IV
42	None	31	M	Health donner	125	None
43	None	27	M	Health donner	133	None
44	None	24	F	Health donner	134	None
45	None	28	F	Health donner	136	None
46	None	28	M	Health donner	127	None

Supplementary Table 3. Clinical information for with the 15 cancer patients used to study the inhibitory effects of $CD45^+$ and $CD45^-$ EPCs on $CD8^+$ T cell function (Fig. 4h, j-n).

No.	ID	Age	Gender	Diagnosis	Hb(g/L)	Stage
1	05108828	57	F	Pleomorphic liposarcoma of the peritoneum	67	III
2	05994934	64	M	Primary bronchogenic lung cancer	74	IV
3	07337183	69	M	Lung squamous cell carcinoma	77	IV
4	07708983	20	F	Mediastinal malignant germ cell tumors	78	III
5	07531718	48	F	Primary bronchogenic lung cancer	88	III
6	05152855	64	F	Primary bronchial adenocarcinoma of the lung	88	IV
7	07277665	46	F	Primary bronchogenic lung squamous cell carcinoma	89	III
8	05310357	71	M	Lung adenocarcinoma	90	III
9	01201637	70	F	Lung squamous cell carcinoma	92	IV
10	05908951	53	M	Left breast infiltrating ductal carcinoma	93	IV
11	05992241	34	M	Gastric adenocarcinoma	95	IV
12	07219424	52	M	Lung adenocarcinoma	98	III
13	07658793	55	F	Gallbladder cancer	98	III
14	07701980	79	F	Lung adenocarcinoma	109	III
15	05991279	52	M	Primary bronchial small cell lung cancer	107	III

Supplementary Table 4. Primer sequences used for RT-qPCR.

Gene	Forward	Reverse
human Fes	AGGACCGTGACAAGGCTAAG	CCTTCAGGATGCAAGCCATCT
human Glrx	CCCATCAAACAAGGGCTTCTG	CTGCATCCGCCTATACAATCTT
human Gpx3	AGAGCCGGGGACAAGAGAA	ATTTGCCAGCATACTGCTTGA
human Gpx4	GAGGCAAGACCGAAGTAAACTAC	CCGAACTGGTTACACGGGAA
human Gsr	CACTTGCGTGAATGTTGGATG	TGGGATCACTCGTGAAGGCT
human Mgst1	ATGACAGAGTAGAACGTGTACGC	TACAGGAGGCCAATTCCAAGA
human Mpo	TGCTGCCCTTTGACAACCTG	TGCTCCCGAAGTAAGAGGGT
human msra	GGCCATCTACCCGACCTCT	GCCATTGGGGTTCTTGCTCA
human prnp	AGTCAGTGGAACAAGCCGAG	CTGCCGAAATGTATGATGGGC
human cybb	CACAGGCCTGAAACAAAAGA	GCTTCAGGTCCACA GAGGAA.
mouse cybb	TGTGGTTGGGGCTGAATGTC	CTGAGAAAGGAGAGCAGATTTCG