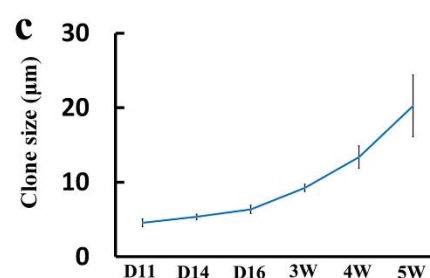
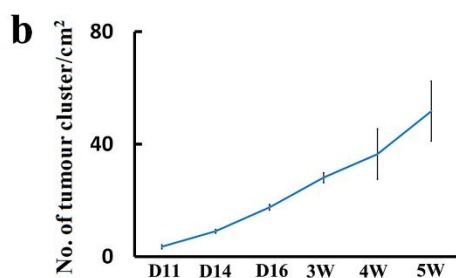
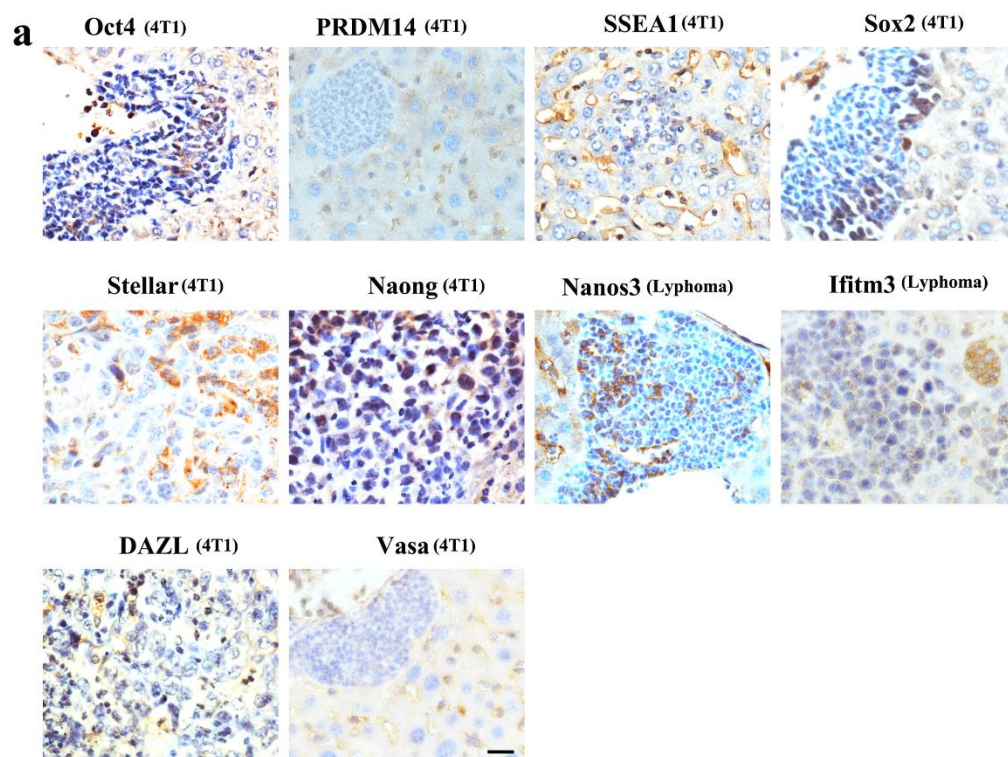
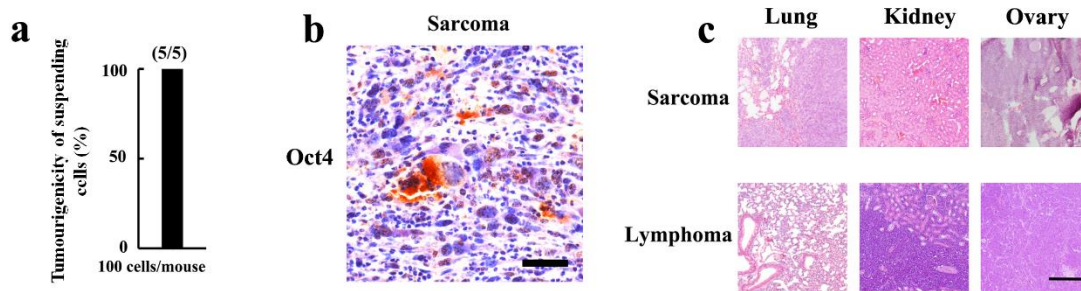


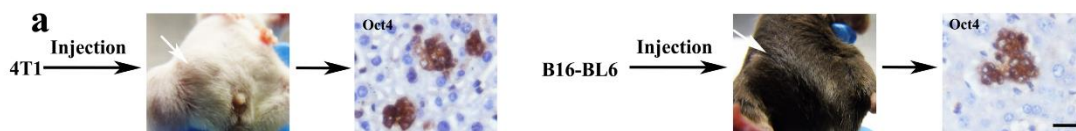
## Supplementary Information



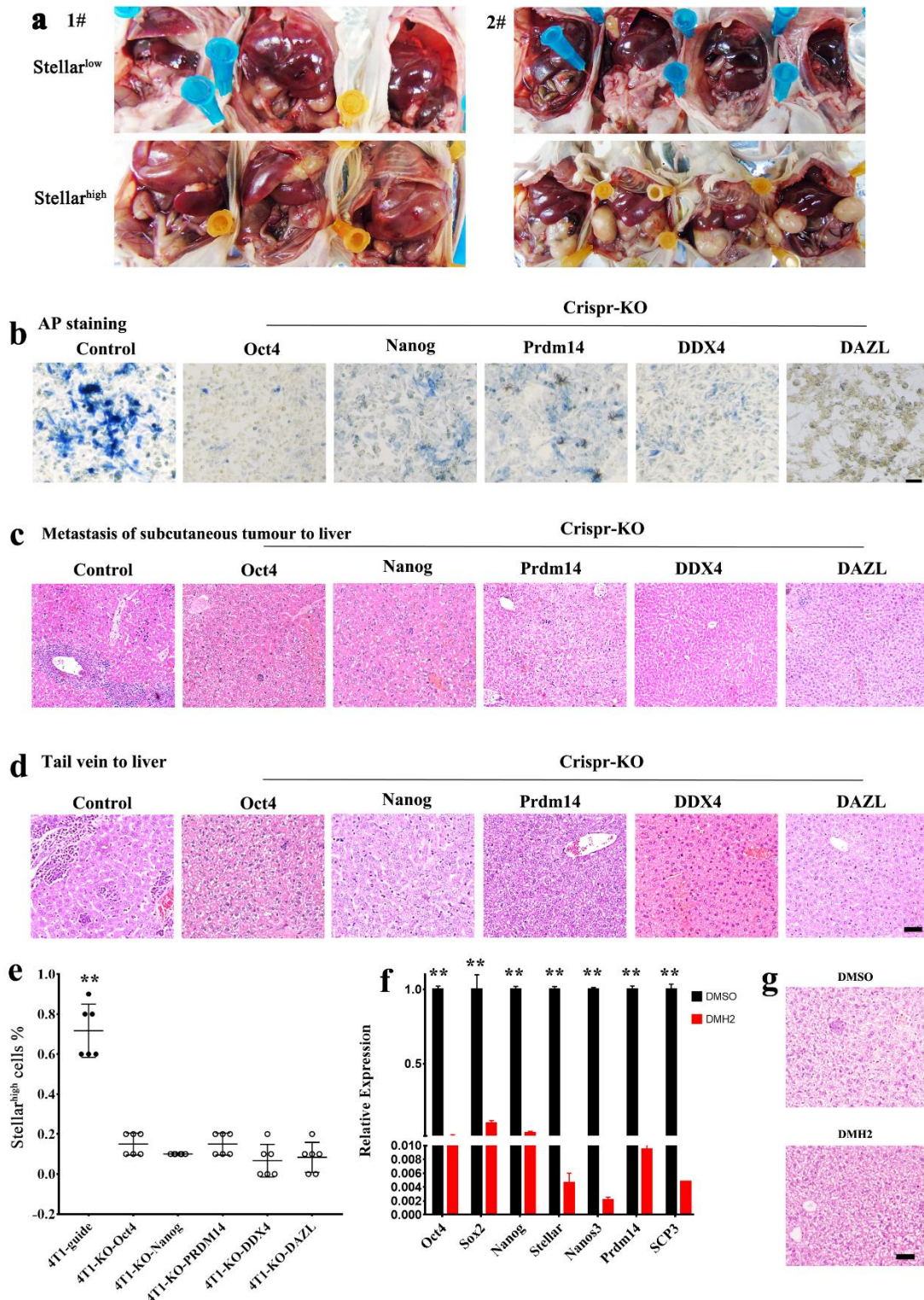
**Supplementary Fig. S1. Traits of liver metastasis.** (a) The differentiated somatic tumour cells in liver of the mice inoculated with lymphoma or 4T1 cells showed low level of the expression of PGC-related markers. (b) The plot shows the density of 4T1 tumour cells in liver at different time points. (c) The plot shows the changes of 4T1 tumour clone size in liver metastases at different time points. Scale bar=50µm.



**Supplementary Fig. S2. PGC-like cells colonize to liver.** (a) The plot shows the tumorigenicity of suspended 4T1 cells (100 cells/mouse) subcutaneously injected into nude mice. (b) Sarcoma tumour sections from  $p53^{-/-}$  mice were stained with Oct4 antibody. (c) Histological analysis of various tissues from the mice inoculated with sarcomas or lymphomas tumour cells from  $p53^{-/-}$  mice 15 days after the tail vein injection.  $**p < 0.01$ . Scale bar = 100  $\mu\text{m}$  (b), 200  $\mu\text{m}$  (c).



**Supplementary Fig. S3. The ability of PGC-like tumour cells to overcome the physical and biological hurdles.** (a) PGC-like tumour cells survived in mouse liver with normal immune system. Scale bar = 50  $\mu\text{m}$ .



**Supplementary Fig. S4. Genetic deletion of the genes critical for PGC development represses the formation of PGC-like cells and liver metastasis.** (a) The images of various tissues from the mice inoculated with Stellar<sup>low</sup> and Stellar<sup>high</sup> tumour cells sorted from two different lymphomas of *p53*<sup>-/-</sup> mice through the tail vein injection (arrow showed the ovary tumours). (b) AP staining of 4T1 cells with control and

knockout in diverse PGC-related genes. (c) Histological analysis of liver tissues from the mice subcutaneously injected with 4T1 cells with control and knockout in diverse PGC-related genes 25 days after injection. (d) Histological analysis of liver tissues from the mice inoculated with 4T1 cells with control and knockout in diverse PGC-related genes 15 days after the tail vein injection. (e) Stellar<sup>high</sup> tumour cells were determined by FCS in 4T1 cells with control and knockout in diverse PGC-related genes. (f) The real-time PCR analysis of the expression of PGC-related genes in 4T1 cells treated with DMSO or DMH2 (6  $\mu$ M) for 3 days. (g) Histological analysis of the liver tissues of the mice injected with 4T1 cells treated with DMSO or DMH2 (6  $\mu$ M) for 3 days after 6 days of the tail vein injection. \*\*p<0.01. Scale bar= 50  $\mu$ m.

**Supplementary Table S1.** Sequencing data of CRIPSR-Cas9 knockout 4T1 cells.

Gene	Knock out DAN with CRISPR-Cas9	
Oct4-1#	<p>Query 74 GAGGATCACCTTGGGGTACACCCAGGCCGAC---CGCGCCGCCGGGCTGTTGTTGG 129</p> <p>     </p> <p>Sbjct 35509165 GAGGATCACCTTGGGGTACACCCAGGCCGAC<b>GTGGGG</b>CTCACCTGGGCGTTCTCTTTGG 35509224</p> <p>sgRNA: GTACACCCAGGCCGACGTGGGG <b>Del:4bp</b></p>	
Oct4-2#	<p>Query 62 CTGAAGCAGAAGAGGATCACCTTGGGGTACACCCAGGCCGAC<b>CGTGGGG</b>CTCACCTGGG 121</p> <p>     </p> <p>Sbjct 35509154 CTGAAGCAGAAGAGGATCACCTTGGGGTACACCCAGGCCGAC<b>GTGGGG</b>CTCACCTGGG 35509212</p> <p>sgRNA:GTACACCCAGGCCGACGTGGGG <b>Int:1bp</b></p>	
Nanog-1#	<p>Query 240 AAGCAGAAGATGCGGACTGTGTTCTCACACGCCAGCTGTGTGCCCTC----- 287</p> <p>     </p> <p>Sbjct 122711672 AAGCAGAAGATGCGGACTGTGTTCTCTCAGGCCAG<b>CTGTGTGCACTCAAGGACAGGTTT</b> 122711731</p> <p>sgRNA: GCTGTGTGCA<b>CTCAAGGACAGG</b> <b>Del:37bp</b></p> <p>Query 288 ---AGCAG-----AGGCTCC-----AAATCTCATCCATTCCGACCCCG 322</p> <p>                                         </p> <p>Sbjct 122711732</p> <p><b>CAGAAGCAGAAGTACCTCAGCCTCCAGCAGATGCAAGA</b>ACTCTCCTCCATTCTGAACCTG 122711791</p>	
Nanog-2#	<p>Query 244 AAGATGC 250</p> <p>     </p> <p>Sbjct 122711678 AAGATGC 122711684 <b>Del:86bp</b></p> <p>sgRNA: GCTGTGTGCACTCAAGGACAGG</p> <p>Query 1 AAGAACTCTCCTCCATTCTGAACCTGAGCTATAAGCAGGTGGGGTCTTAAAAGTTGCT- 59</p> <p>     </p> <p>Sbjct 122711766 AAGAACTCTCCTCCATTCTGAACCTGAGCTATAAGCAGGTGGGGTCTTAGAAGTTGCTG 122711825</p>	
Prdm14-1#	<p>Query 61 GTAGAGTGGTCAACGCCCGCGATGTAGAGGAAGTACAGTGTACTATCTCTCGGTGGTGG 120</p> <p>     </p> <p>Sbjct 13124421 GTAGAGTGGTCAATGCCAGCGAAGTGAAGGCA-CACAG-GGAC-AACTCTCGGAT-GTGG</p> <p>sgRNA: GTCAATGCCAGCGAAGTGAAGG <b>Int: 4bp</b></p>	
Prdm14-2#	<p>Query 662 TGGACCCTTTCGAG 675</p> <p>     </p> <p>Sbjct 13124435 TGGACCCTTTCGAG 13124422 <b>Del: 323bp</b></p> <p>sgRNA: GTCAATGCCAGCGAAGTGAAGG</p> <p>Query 1 GCATGCTACAGGAAAGAAAGACAAGTTTTAGACTTTCATGTTACTT 46</p>	

	Sbjct	13124098 GCATGCTACAGGAAAGAAAGACAAGTTTACACTTTCATGTTACTT 13124053	
<b>DDX4-1#</b>	Query	243 ATTTTTCAGATATTGGCGAGTCTAGTAAAAAAGAGAACACATCTAC--GTGGGGGGTTT 300	
	Sbjct	112636055 ATTTTTCAGATATTGGCGAGTCTAGTAAAAAAGAGAACACATCTACA <b>ACTGGTGGCTTT</b> 112635996	
		sgRNA: AGAACACATCTACA <b>ACTGGTGG Del: 2bp</b>	
<b>DDX4-2#</b>	Query	251 ATATTGGCGAGTCTAGTAAAAAAGAGAACACATCTACA <b>ACT</b> -----TGAAGAGGAA 302	
	Sbjct	112636045 ATATTGGCGAGTCTAGTAAAAAAGAGAACACATCTACA <b>ACTGGTGGCTTT</b> TGAAGAGGAA 112635986	
		sgRNA: AGAACACATCTACA <b>ACTGGTGG Del: 8bp</b>	
<b>DAZL-1#</b>	Query	309 TCATGCCAAACACCGTTTTTGT----AGAATAGATGTATGTCAATCGAATTTATATTTAA 364	
	Sbjct	50289132 TCATGCCAAACACCGTTTTTGT <b>TGGAGGA</b> AATTGATGTTAGGTTATTGTATTCATATTTCA 50289073	
		sgRNA: CAAACACCGTTTTTGT <b>TGGAGG Del: 4bp</b>	
<b>DAZL-2#</b>	Query	310 ATGCCAAACACCGTTTTTGT <b>TGGAGGA</b> AATGATGTTAGGTTATTGTATTCATATTTTCATT 368	
	Sbjct	50289130 ATGCCAAACACCGTTTTTGT <b>TGGAGGA</b> AATGATGTTAGGTTATTGTATTCATATTTTCATT 50289071	
		sgRNA: CAAACACCGTTTTTGT <b>TGGAGG Del: 1bp</b>	
<b>SMAD2-1#</b>	Query	302 TAAAAAGTCTCTCCITTTTCCCTTGCTCCAAATAGGTCCTTGACGGCC----- 353	
	Sbjct	76287890 TAAAAAGTCTCTCCITTTTCCCTTGCTCCAAATAGG <b>TCTCTGATGGCCGCTCTCAG</b> 76287949	
		sgRNA: TCTCTGATGGCCGCTCTCAG <b>Del:19bp</b>	
	Query	354 -----GAAAGGGTTGCCACATGTTATATATTGCCGGCTCTGGCGCTGGCCGGAC 402	
	Sbjct	76287950 <b>GTTTCACACCG</b> GAAAGGGTTGCCACATGTTATATATTGCCGGCTCTGGCGCTGGCCGGAC 76288009	
<b>SMAD2-2#</b>	Query	491 AAGATGAAGTGTGTGTAATCCGTACCACTA-CAGAGAGTTGACACCCAGGTAAGAAAC 549	
	Sbjct	76288071 AAGATGAAGTGTGTGTAATCCGTACCACTA <b>CCAGAGAGTTGAGACCC</b> AGGTAAGAAAC 76288130	
		sgRNA: CCACTACAGAGAGTTGAGACC <b>Del:1bp</b>	