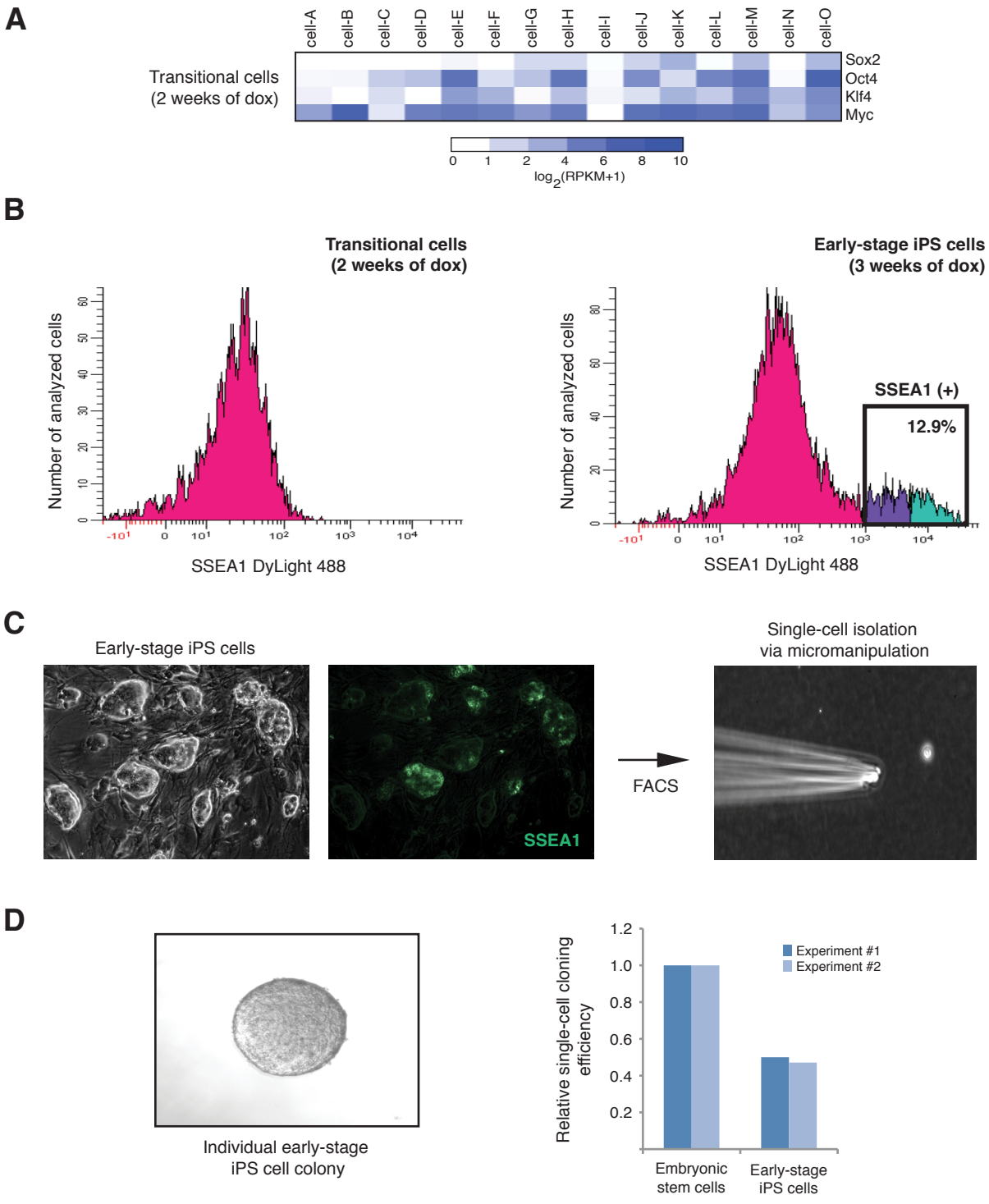

Figure S1, Related to Figure 1. Characterization of transitional and early-stage iPS cells
(A) Heatmap of OSKM transgene expression, as determined by single-cell RNA-seq. RPKM, reads per kilobase per million mapped reads. dox, doxycycline. (B) Flow cytometry analysis of SSEA1 expression. (C) Phase contrast and fluorescent images of early-stage iPS cell colonies stained with anti-SSEA1 and single-cell isolation using micromanipulation. (D) Phase contrast image of an individual iPS cell colony seeded by a single cell sorted into 96-plate format and relative single-cell cloning efficiencies of ES and early-stage iPS cells.

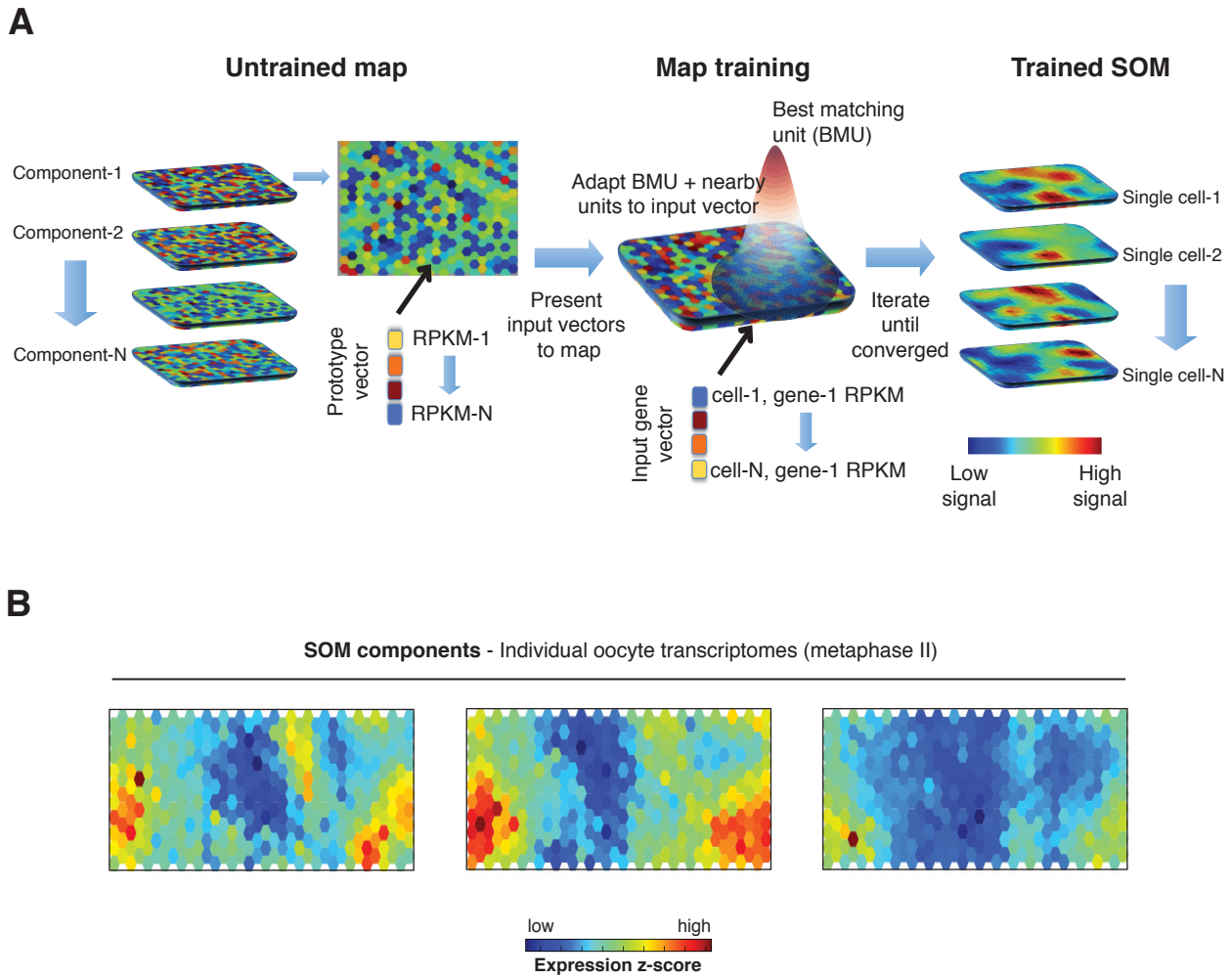

Figure S2, Related to Figure 2. Self-organizing map (SOM) and oocyte SOM components
(A) A gene is clustered according to the minimum distance of its expression vector from prototype vectors assigned to units in a 2D grid. Initial vectors can be chosen in a variety of ways. In this work, they are initialized by mapping the first two principal components of the data onto the grid. Training proceeds by incrementally moving each prototype toward input vectors that map near it, using a weighting that decreases with map distance from the best matching unit (BMU). The trained SOM consists of prototypes adapted to input data and exhibits spatial organization of units in larger-scale clusters across the grid. Colorbar represents $\log_2$transformation of normalized data vectors, where normalization is performed on a gene-by-gene basis by subtracting the vector mean and dividing by its standard deviation. (B) Single-cell ooycte transcriptomes depicted as individual components of the self-organizing map (SOM).

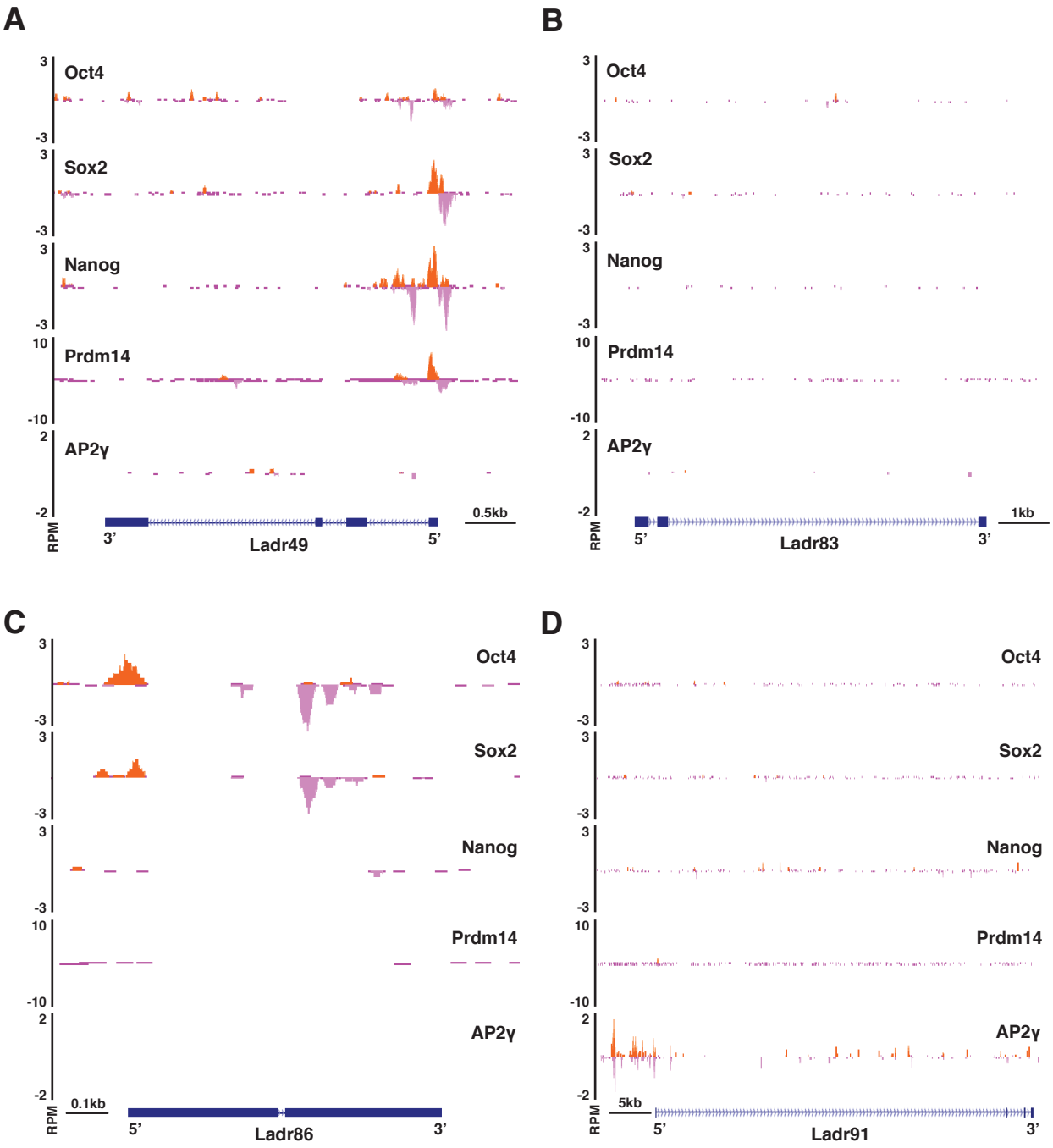

Figure S3, Related to Figure 4. LncRNA regulation by pluripotency and germ cell factors
Genome browser ChIP-seq profiles of the Ladr49 (A), Ladr83 (B), Ladr86 (C), and Ladr91 (D) lncRNA genes. RPM, reads per million.

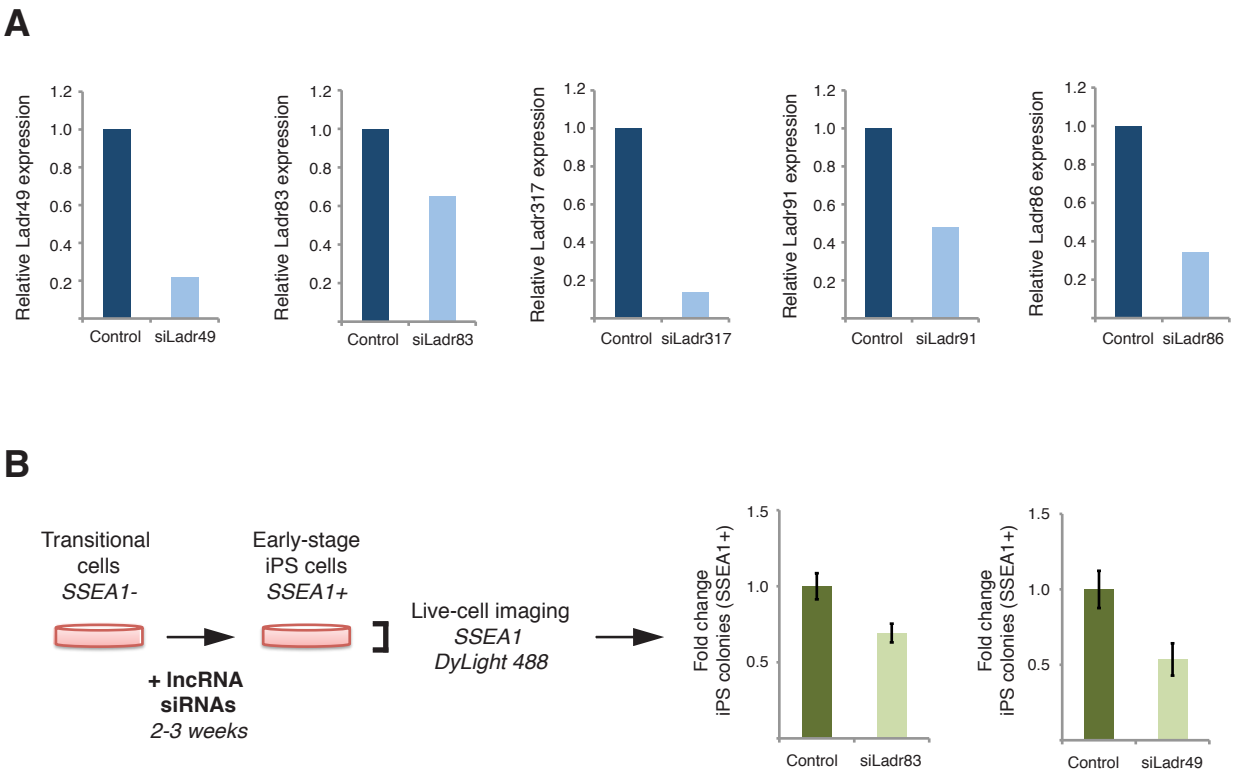

Figure S4, Related to Figure 5. Effects of Ladr knockdown on reprogramming efficiency
(A) Relative expression of lncRNAs in iPS cells transfected with control or Ladr-specific siRNAs, as determined by RNA-seq. (B) Fold-change in the number of SSEA1+ iPS cell colonies in reprogramming cells transfected with control or Ladr-specific siRNAs.

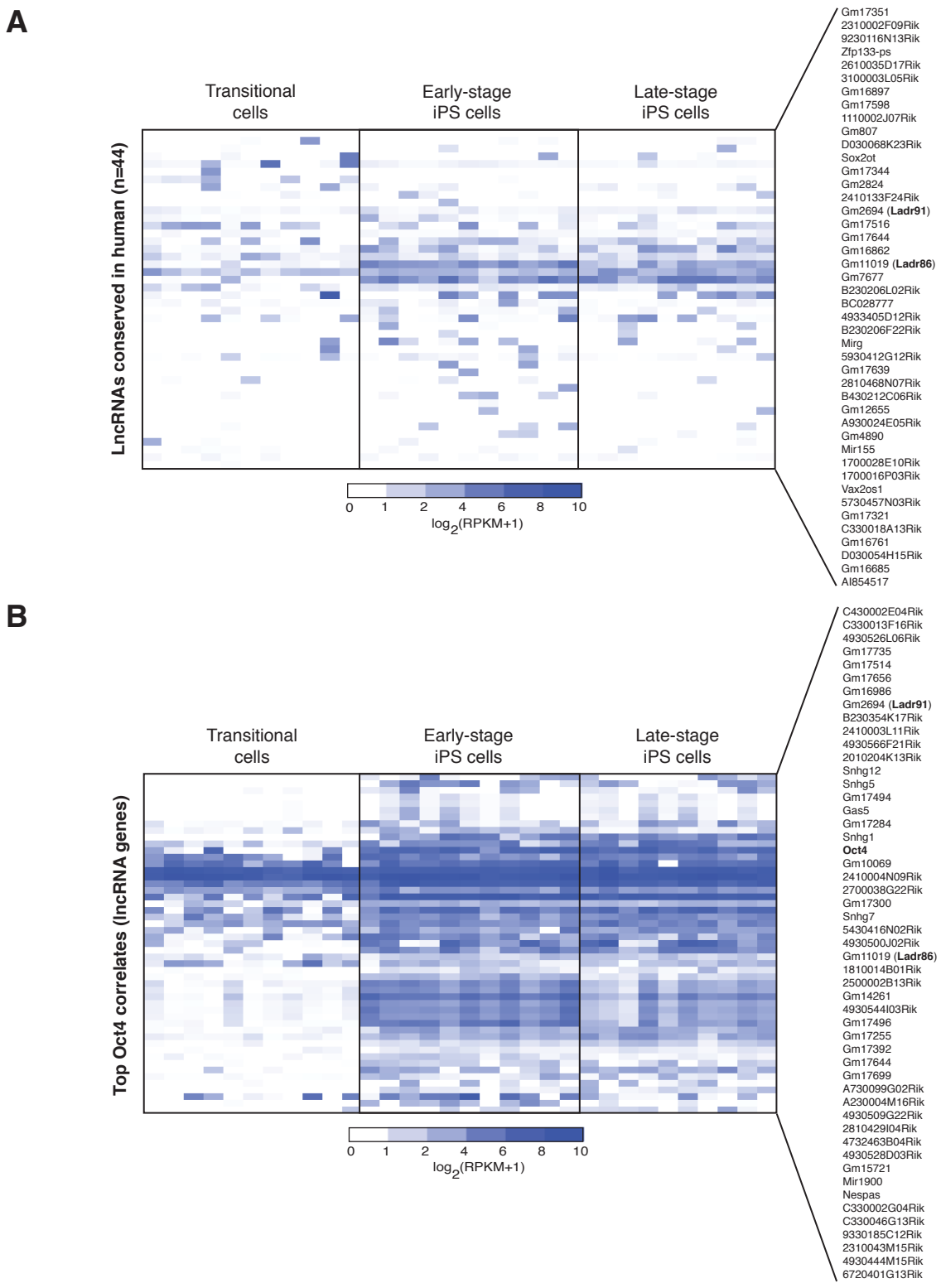

Figure S5, Related to Figure 7. Conserved lncRNAs and top lncRNA correlates of *Oct4*
(A) Heatmap of activated lncRNAs conserved in human, as determined by liftOver analysis and single-cell RNA-seq. (B) Heatmap of lncRNA genes that correlate most highly (Pearson correlation) with *Oct4* expression during the reprogramming time course, as determined by single-cell RNA-seq. RPKM, reads per kilobase per million mapped reads.

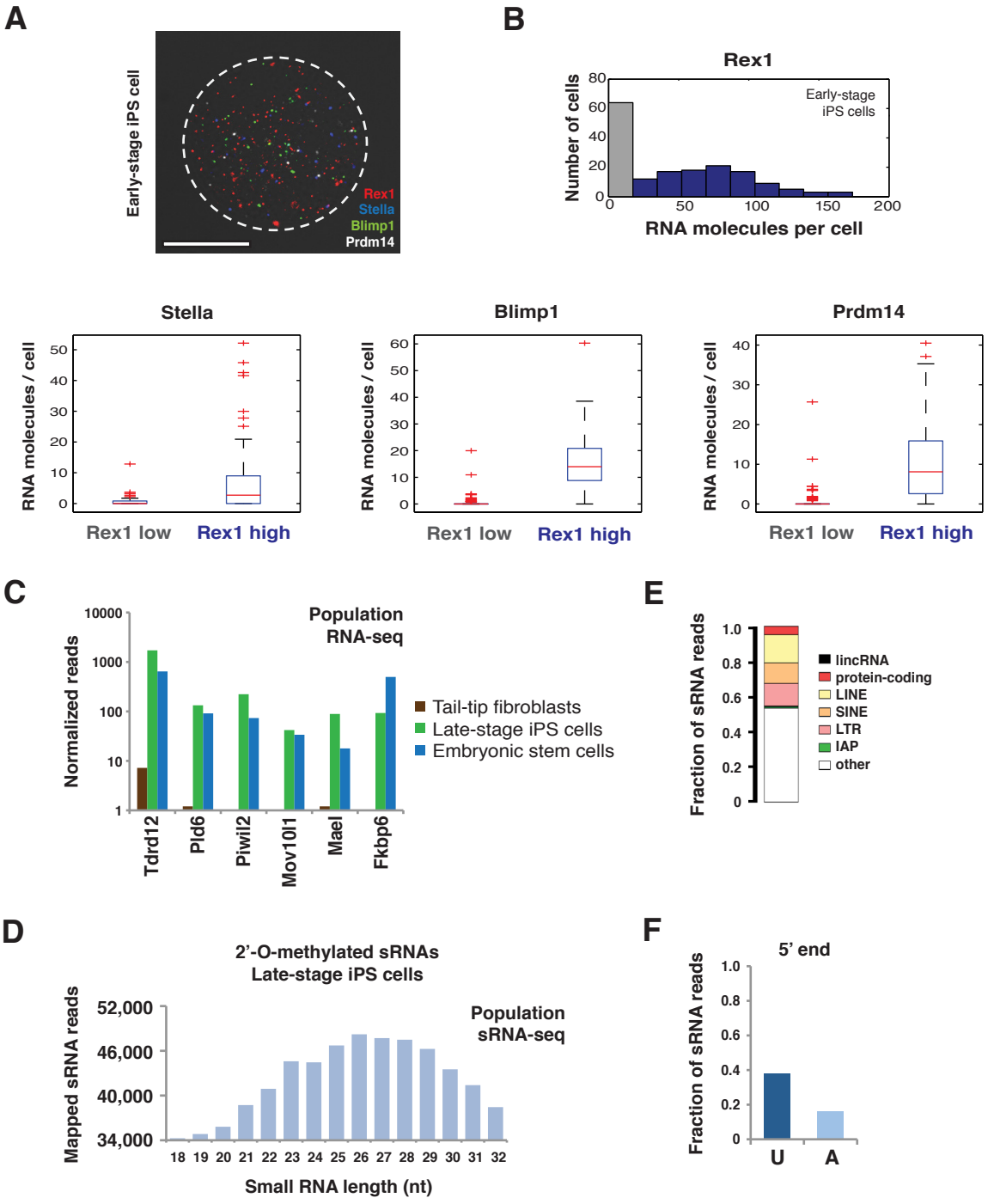

Figure S6, Related to Figure 7. Germ cell genes and 2'-O-methyled sRNAs in iPS cells
(A) Representative fluorescence image of a single early-stage iPS cell using 4-color smFISH. Scale bar,10 um. (B) Histogram and box plots showing RNA molecules per cell for each indicated gene, as determined by smFISH. Red cross symbols indicate outliers. (C) Effective read counts (normalized reads) for piRNA pathway genes in indicated cell types, as determined by population level RNA-seq. (D) Size distribution of 2'-O-methylated small RNAs (sRNAs) in iPS cells, as determined by population level small RNA-seq. (E) Genomic annotations of 2'-O-methylated small RNAs. (F) Fraction of 2'-O-methylated small RNAs that begin with a 5' U or A.

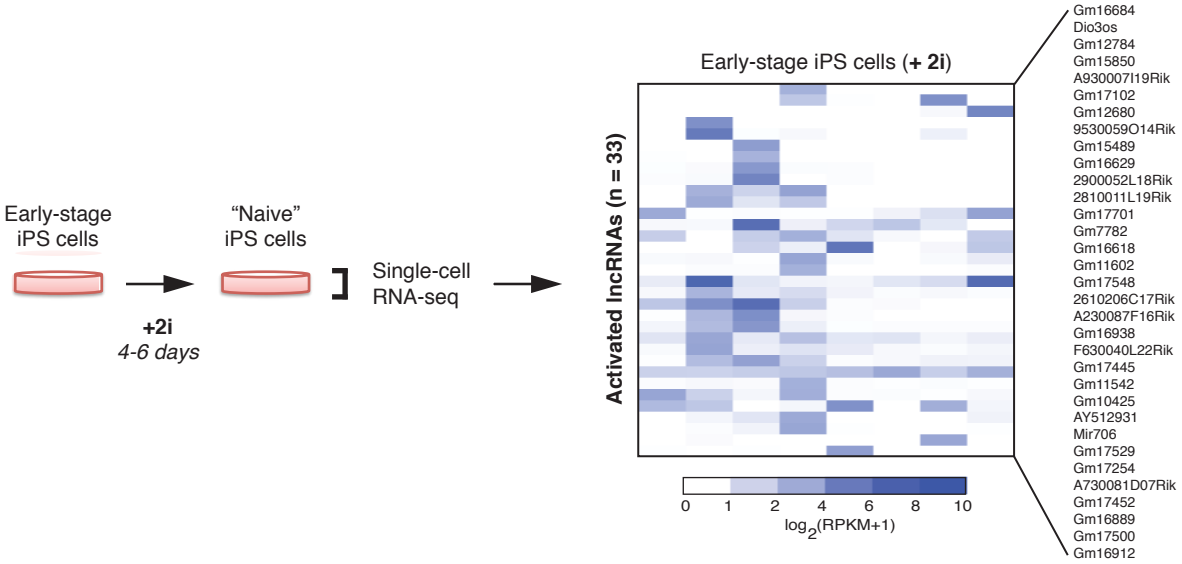

Figure S7, Related to Figure 7. LncRNAs activated under "2i" conditions in iPS cells
Schematic illustration of "2i" experiments and heatmap of lncRNAs activated (>10 RPKM) in early-stage iPS cells cultured in "2i" conditions for 4-6 days, as determined by single-cell RNA-seq. RPKM, reads per kilobase per million mapped reads.

Table S1, Related to Figure 2. Self-organizing map clustering of lncRNAs

SOM Cluster: 0	SOM Cluster: 2	SOM Cluster: 7	SOM Cluster: 9	SOM Cluster: 21	SOM Cluster: 25
Atp10d	Meg3	Gm10069	B230354K17Rik	Ttc28	8430429K09Rik
C230037L18Rik	Gm17291	Gm17644	5430416N02Rik	1810034E14Rik	Gm9917
A930029G22Rik	R74862	Gm11019	Gm16624	Gpr137b-ps	Gm14488
2310002F09Rik	4930513N10Rik	Gm17290	Gm11974	9330179D12Rik	Enox
A730020E08Rik	Gm17682	Gm16627	C530005A16Rik	Gm10785	Bbip1
A330040F15Rik	Gm17516	Gm14261	Gt(ROSA)26Sor	Gm16617	Gm16867
3100003L05Rik	Gm16929	4930509G22Rik	Nespas	6330418K02Rik	D430036J16Rik
Gm16898	A930006K02Rik	2410003L11Rik	Gm12976	Gm16882	Gm16897
2410133F24Rik	BC028777	4930444M15Rik	2410004N09Rik	2900076A07Rik	2010001A14Rik
Gm16703	Gm11732	4930500J02Rik	Gm17246	Gm15559	D330023K18Rik
2610035D17Rik	3110056K07Rik	9330185C12Rik	Gm10060	1700030C12Rik	2210408F21Rik
A330076H08Rik	Gm12898	2810429I04Rik		Dleu2	4930506C21Rik
9330151L19Rik	Gm13421	4930566F21Rik		C330013E15Rik	Gm15050
Gm7677	2610307P16Rik	C330002G04Rik		Gm17633	2900053A13Rik
Gm17605	Gm16899	E230016M11Rik		Gm17302	Gm17559
Gm17549	Gm13778	Gm17557		Gm17690	
5033417F24Rik	4930405A21Rik	A230004M16Rik			
Gm17115	2810425M01Rik	Gm17392			
Gm17354	C430042M11Rik	Gm17255			
	4933431E20Rik	Gm17250			
	9430065F17Rik	Gm17284			
	4933407K13Rik	Gm17300			
	1700030G06Rik	Gm17625			
	Gm16869	Mir1900			
	Gm5091	Gm17699			
	Gm17639	Gm17596			
	D930030I03Rik	A730099G02Rik			
	D930016D06Rik	Gm17496			
	Gm17588	4930544I03Rik			
	Mirg				
	Gm6297				
	Gm17279				
	Gm17591				
	Rian				
	Gm17442				

Table S3, Related to Figure 4. Polycomb-bound activated lncRNAs

4930429F24Rik	B430010I23Rik	B430010I23Rik	Gm17259	C530005A16Rik
Gm14022	1700023H06Rik	1700023H06Rik	A430108E01Rik	Gm15545
Gm16933	Gm17400	Gm17400	1700030G06Rik	3010001F23Rik
C030010L15Rik	Gm17518	Gm17518	B230354K17Rik	2610206C17Rik
A330048O09Rik	2610035F20Rik	2610035F20Rik	9830144P21Rik	A930007I19Rik
Gm17351	4930520O04Rik	4930520O04Rik	Gm14261	C130036L24Rik
Gm10492	1110002J07Rik	1110002J07Rik	Gm12743	Gm10785
Gm5091	Gm16889	Gm16889	9530027J09Rik	Gm17639
Gm13562	Gm17452	Gm17452	Gm17516	Mirg
Gm10575	Gm2366	Gm2366	B230208H11Rik	D930016D06Rik
Gm4890	Gm17529	Gm17529	4933427G23Rik	Gm5106
C330018A13Rik	5730420D15Rik	5730420D15Rik	4930509G22Rik	Gm17683
Gm17115	Gdap10	Gdap10	Mir706	2700086A05Rik
1010001B22Rik	BC028777	BC028777	4833417C18Rik	4930513N10Rik
Gm14817	Gm16618	Gm16618	2310058D17Rik	Gm17291
Gm17440	Gm7782	Gm7782	1700007J10Rik	Gm15441
Gm4673	4930461G14Rik	4930461G14Rik	Gm6410	1810019D21Rik
A930011O12Rik	Gm13261	Gm13261	Gm16624	Gm17502
Gm16641	6720401G13Rik	6720401G13Rik	Gm15787	1700001G11Rik
Gm17335	1700086P04Rik	1700086P04Rik	Mir1900	2610035D17Rik
5730457N03Rik	G730013B05Rik	G730013B05Rik	Gm16973	2700012I20Rik
Gm16159	Gm12592	Gm12592	Nespas	Gm16882
Gm17321	Gm16845	Gm16845	Gm16096	Gm15489
Gm13110	C430002E04Rik	C430002E04Rik	B230206L02Rik	3110045C21Rik
D230017M19Rik	C330046G13Rik	C330046G13Rik	Gm11602	Gm17637
1700016P03Rik	C330002G04Rik	C330002G04Rik	Gm17548	Gm8098
A030003K02Rik	C330013F16Rik	C330013F16Rik	C030005K06Rik	Gm17422
Gm17460	Gm10143	Gm10143	1700095J07Rik	2310002F09Rik
Six3os1	Gm16892	Gm16892	Gm4262	C230037L18Rik
Gm16972	Gm16880	Gm16880	Gm10425	A930029G22Rik
B430212C06Rik	4930444M15Rik	4930444M15Rik	Gm11769	
2810468N07Rik	Gm17254	Gm17254	Gm17559	
Gm17238	2310043M15Rik	2310043M15Rik	2410133F24Rik	
Gm807	2500002B13Rik	2500002B13Rik	Gm16867	
D030068K23Rik	Gm2694	Gm2694	Gm17682	
Gm6297	2410003L11Rik	2410003L11Rik	Gm17491	
F730043M19Rik	4930500J02Rik	4930500J02Rik	4933407K13Rik	
2810011L19Rik	Gm10069	Gm10069	Gm16790	
Gm16568	Gm11019	Gm11019	Sox2ot	
Gm17442	1810014B01Rik	1810014B01Rik	4930594M22Rik	

Table S4, Related to Figure 7. Top 50 lncRNAs anti-correlated with *Oct4* expression

Col5a2	Snord123
Gm14005	7530420F21Rik
Gm2115	Gm16907
BC029722	A430018G15Rik
8030451A03Rik	2810029C07Rik
Gm17315	Gm16898
Gm17371	D430036J16Rik
Gm13372	Gm17437
Gm10561	1810058I24Rik
Ttc28	Gm13476
Gm13986	C030005K06Rik
Gm16661	Gm16596
Hoxa11as	9930014A18Rik
Gm6634	Gm17302
A930001C03Rik	A830012C17Rik
Gm17311	Gm16767
Gm14488	4921504A21Rik
2210408F21Rik	1700006J14Rik
2010001A14Rik	9130206I24Rik
Gm16801	2210411M09Rik
1110054M08Rik	2010300F17Rik
2810430I11Rik	4833418N02Rik
Gm17698	5830432E09Rik
Gm17447	Gm14636
Gm17633	4932415G12Rik

Table S5, Related to Figure 7. LncRNA activation kinetics

I. Early activation: SSEA1- cells		
1010001B22Rik	B230206F22Rik	Gm16952
1110020A21Rik	B230206L02Rik	Gm16972
1500026H17Rik	B230208H11Rik	Gm16973
1700007J10Rik	B230344G16Rik	Gm16994
1700028E10Rik	C230037L18Rik	Gm17115
1700030G06Rik	D030054H15Rik	Gm17238
1700095J07Rik	Enox	Gm17276
1810014B01Rik	Gm10069	Gm17291
2010015M23Rik	Gm10575	Gm17336
2310002F09Rik	Gm10785	Gm17344
2310010J17Rik	Gm11019	Gm17372
2310015A10Rik	Gm11538	Gm17422
2310043M15Rik	Gm11613	Gm17477
2310069G16Rik	Gm11638	Gm17491
2410133F24Rik	Gm12059	Gm17516
2500002B13Rik	Gm12592	Gm17540
2610027K06Rik	Gm12743	Gm17559
2610035D17Rik	Gm12898	Gm17588
2700012I20Rik	Gm13657	Gm17598
2810468N07Rik	Gm13830	Gm17639
3100003L05Rik	Gm15545	Gm17690
3110045C21Rik	Gm15559	Gm17702
4833417C18Rik	Gm15888	Gm17716
4930417H01Rik	Gm16244	Gm2449
4930429F24Rik	Gm16617	Gm4262
4930461G14Rik	Gm16641	Gm4890
4930500J02Rik	Gm16685	Gm7677
4930513N10Rik	Gm16703	Gm8098
4933427G23Rik	Gm16733	Gm9903
9330151L19Rik	Gm16761	Mir155
A030003K02Rik	Gm16845	Six3os1
A230056P14Rik	Gm16862	Ttc28
A330032B11Rik	Gm16867	Zfp133-ps
A330076H08Rik	Gm16882	
A730020E08Rik	Gm16884	
A930029G22Rik	Gm16897	
AV039307	Gm16898	
AW047730	Gm16907	

II. Late activation: SSEA1+ cells					
0610005C13Rik	4933407K13Rik	C330002G04Rik	Gm16096	Gm17502	Nespas
1110002J07Rik	4933439K11Rik	C330013F16Rik	Gm16159	Gm17517	Sox2ot
1500017E21Rik	5033417F24Rik	C330018A13Rik	Gm16170	Gm17518	Tdrd5
1700001G11Rik	5330411J11Rik	C330046G13Rik	Gm16233	Gm17557	Vax2os1
1700016P03Rik	5330434G04Rik	C430002E04Rik	Gm16283	Gm17561	
1700023H06Rik	5730405O15Rik	C430039J16Rik	Gm16568	Gm17568	
1700023L04Rik	5730420D15Rik	C430042M11Rik	Gm16613	Gm17594	
1700026J14Rik	5730457N03Rik	C530005A16Rik	Gm16624	Gm17597	
1700086O06Rik	5930412G12Rik	D030055H07Rik	Gm16706	Gm17625	
1700086P04Rik	6030442K20Rik	D030068K23Rik	Gm16790	Gm17630	
1810019D21Rik	6430562O15Rik	D230017M19Rik	Gm16853	Gm17637	
2310058D17Rik	6720401G13Rik	D930016D06Rik	Gm16880	Gm17644	
2410003L11Rik	9230116N13Rik	D930048G16Rik	Gm16892	Gm17656	
2610035F20Rik	9330185C12Rik	E030007J07Rik	Gm16899	Gm17682	
2700086A05Rik	9430065F17Rik	E130018N17Rik	Gm16913	Gm17683	
2810425M01Rik	9530027J09Rik	F730043M19Rik	Gm16933	Gm17692	
2810429I04Rik	9530080O11Rik	G530011O06Rik	Gm16986	Gm17699	
3010001F23Rik	9830144P21Rik	G730013B05Rik	Gm17246	Gm17710	
4732487G21Rik	A230004M16Rik	Gdap10	Gm17250	Gm17713	
4833407H14Rik	A230107N01Rik	Gm10143	Gm17255	Gm17717	
4921507G05Rik	A330035P11Rik	Gm10492	Gm17259	Gm17718	
4930404I05Rik	A330048O09Rik	Gm10565	Gm17317	Gm2366	
4930405A21Rik	A430105J06Rik	Gm10658	Gm17321	Gm2464	
4930444M15Rik	A430108E01Rik	Gm11638	Gm17322	Gm2529	
4930467K11Rik	A730011C13Rik	Gm11714	Gm17335	Gm2694	
4930480K23Rik	A730099G02Rik	Gm11732	Gm17351	Gm2788	
4930481B07Rik	A930006K02Rik	Gm11769	Gm17357	Gm2824	
4930483K19Rik	A930011O12Rik	Gm12655	Gm17392	Gm4349	
4930509E16Rik	A930024E05Rik	Gm13110	Gm17400	Gm4673	
4930509G22Rik	Abhd1	Gm13261	Gm17418	Gm5091	
4930520O04Rik	AI854517	Gm13562	Gm17440	Gm5101	
4930526L06Rik	B230206H07Rik	Gm13778	Gm17442	Gm5106	
4930532G15Rik	B230354K17Rik	Gm14022	Gm17460	Gm6297	
4930544I03Rik	B430010I23Rik	Gm14261	Gm17461	Gm6410	
4930556M19Rik	B430212C06Rik	Gm14817	Gm17463	Gm6846	
4930566F21Rik	BC028777	Gm15441	Gm17470	Gm807	
4930583K01Rik	BC046401	Gm15787	Gm17478	Gm8378	
4930594M22Rik	C030005K06Rik	Gm16023	Gm17481	Kis2	
4933404O12Rik	C030010L15Rik	Gm16046	Gm17496	Mir1900	
4933405D12Rik	C130036L24Rik	Gm16065	Gm17501	Mirg	