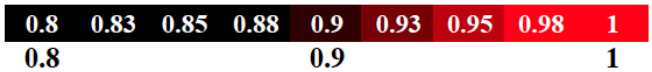
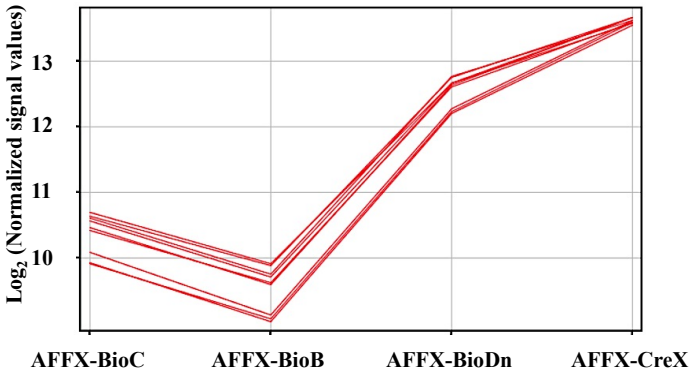
Supplementary Figure S1

A

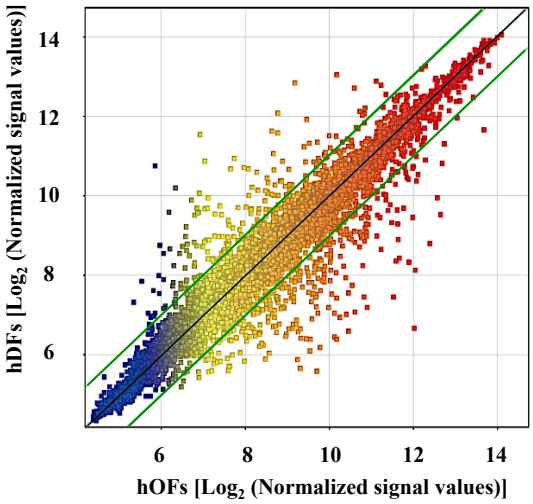
Array Name (sample name)	hOF2	hOF3	hOF4	hDF (TIG110)	hDF (TIG111)	hDF (TIG114)	hOF-iPSC3	hOF-iPSC2	hOF-iPSC4
hOF2	1	0.99	0.96	0.97	0.97	0.94	0.77	0.78	0.77
hOF3	0.99	1	0.97	0.97	0.97	0.95	0.77	0.78	0.77
hOF4	0.96	0.97	1	0.95	0.92	0.96	0.78	0.79	0.78
hDF (TIG110)	0.97	0.97	0.95	1	0.97	0.97	0.78	0.79	0.78
hDF (TIG111)	0.97	0.97	0.92	0.97	1	0.94	0.77	0.78	0.76
hDF (TIG114)	0.94	0.95	0.96	0.97	0.94	1	0.78	0.78	0.79
hOF-iPSC3	0.77	0.77	0.78	0.78	0.77	0.78	1	0.99	0.99
hOF-iPSC2	0.78	0.78	0.79	0.79	0.78	0.78	0.99	1	0.99
hOF-iPSC4	0.77	0.77	0.78	0.78	0.76	0.79	0.99	0.99	1



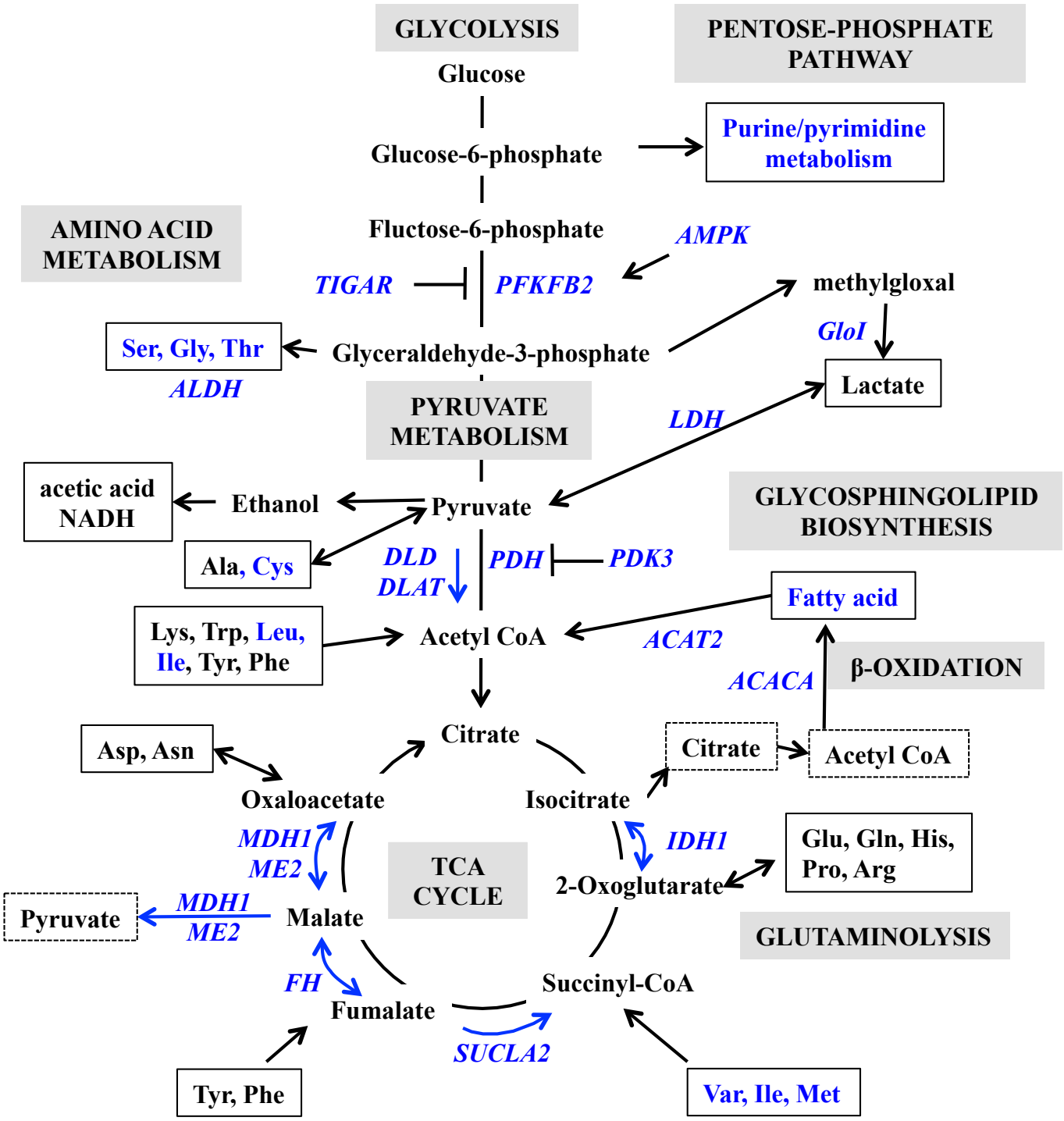
B



C



Supplementary Figure S2



Supplementary Figure S3

Entrez GeneID	*Gene Symbol*	*Gene Name*	hODs	hDFs	hOF-iPSCs
644	*BLVRA*	*biliverdin reductase A*	223.9	259.3	253.0
3162	*HMOX1*	*heme oxygenase 1*	1474.2	2698.0	452.3
9365	*KL*	*klotho*	54.1	44.8	36.5
10135	*NAMPT*	*nicotinamide phosphoribosyltransferase*	827.7	626.2	2999.8
4780	*NFE2L2*	*nuclear factor (erythroid-derived 2) related factor 2*	2134.5	1331.7	1006.2
5467	*PPARD*	*peroxisome proliferator-activated receptor delta*	1534.6	1352.9	330.8
5468	*PPARG*	*peroxisome proliferator-activated receptor gamma*	524.4	100.8	63.0
5621	*PRNP*	*prion protein*	4059.0	3134.1	1065.5
5925	*RB1*	*retinoblastoma 1*	882.9	805.8	739.3
23411	*SIRT1*	*sirtuin 1*	231.5	216.8	1676.0
7157	*TP53*	*tumor protein p53*	2107.7	2197.0	2149.1

Supplementary Figure S4

Entrez Gene ID	Expressed Allele	Location	*Gene Symbol*	*Gene Name*	hOFs	hDFs	hOF-iPSCs
9077	Paternal	1p31 AS	*DIRAS3*	*DIRAS family, GTP-binding RAS-like 3*	254.9	140.7	72.4
23089	Paternal	7q21	*PEG10*	*paternally expressed 10*	257.1	374.8	1841.9
283120	Maternal	11p15.5 AS	*H19*	*H19, imprinted maternally expressed transcript (non-protein coding)*	1304.4	801.3	559.8
3481	Paternal	11p15.5 AS	*IGF2*	*insulin-like growth factor 2 (somatomedin A)*	1060.0	184.8	82.6
3784	Maternal	11p15.5	*KCNQ1*	*potassium voltage-gated channel, KQT-like subfamily, member 1*	150.2	147.2	107.9
55384	Maternal	14q32	*MEG3*	*maternally expressed 3 (non-protein coding)*	738.9	418.8	476.7
8788	Paternal	14q32	*DLK1*	*delta-like 1 homolog*	161.4	182.5	173.5
388015	Paternal	14q32.31 AS	*RTL1*	*retrotransposon-like 1*	78.9	79.0	68.7
1735	Paternal	14q32	*Dio3*	*deiodinase, iodothyronine, type III*	76.5	84.5	68.6
79104	Maternal	14q32.31	*MEG8*	*maternally expressed 8 (non-protein coding)*	n.d.	n.d.	n.d.
4692	Paternal	15q11.2-q12 AS	*NDN*	*necdin homolog (mouse)*	147.2	122.5	98.9
5178	Paternal	19q13.4 AS	*PEG3*	*paternally expressed 3*	104.5	107.8	86.7

Supplementary Table S2. Gene list in Figure 3D.

Entrez GeneID	*Symbol*	*Gene name*
196883	*ADCY4*	*adenylate cyclase 4*
115	*ADCY9*	*adenylate cyclase 9*
147	*ADRA1B*	*adrenoceptor alpha 1B*
408	*ARRB1*	*arrestin, beta 1*
624	*BDKRB2*	*bradykinin receptor B2*
652	*BMP4*	*bone morphogenetic protein 4*
718	*C3*	*complement component 3*
720	*C4A*	*complement component 4A (Rodgers blood group)*
1675	*CFD*	*complement factor D (adipsin)*
1129	*CHRM2*	*cholinergic receptor, muscarinic 2*
9547	*CXCL14*	*chemokine (C-X-C motif) ligand 14*
58191	*CXCL16*	*chemokine (C-X-C motif) ligand 16*
81624	*DIAPH3*	*diaphanous-related formin 3*
9829	*DNAJC6*	*DnaJ (Hsp40) homolog, subfamily C, member 6*
1909	*EDNRA*	*endothelin receptor type A*
1910	*EDNRB*	*endothelin receptor type B*
1956	*EGFR*	*epidermal growth factor receptor*
30845	*EHD3*	*EH-domain containing 3*
2044	*EPHA5*	*EPH receptor A5*
2051	*EPHB6*	*EPH receptor B6*
2159	*F10*	*coagulation factor X*
2149	*F2R*	*coagulation factor II (thrombin) receptor*
8817	*FGF18*	*fibroblast growth factor 18*
2277	*FIGF*	*c-fos induced growth factor (vascular endothelial growth factor D)*
2321	*FLT1*	*fms-related tyrosine kinase 1*
2869	*GRK5*	*G protein-coupled receptor kinase 5*
3082	*HGF*	*hepatocyte growth factor (hepapoietin A; scatter factor)*
3481	*IGF2*	*insulin-like growth factor 2*
8516	*ITGA8*	*integrin, alpha 8*
3949	*LDLR*	*low density lipoprotein receptor*
4286	*MITF*	*microphthalmia-associated transcription factor*
5228	*PGF*	*placental growth factor*
5468	*PPARG*	*peroxisome proliferator-activated receptor gamma*
5727	*PTCH1*	*patched 1*
2185	*PTK2B*	*protein tyrosine kinase 2 beta*
6092	*ROBO2*	*roundabout, axon guidance receptor, homolog 2 (Drosophila)*
223117	*SEMA3D*	*sema domain, immunoglobulin domain (Ig), short basic domain, secreted, (semaphorin) 3D*
6405	*SEMA3F*	*sema domain, immunoglobulin domain (Ig), short basic domain, secreted, (semaphorin) 3F*
10507	*SEMA4D*	*sema domain, immunoglobulin domain (Ig), transmembrane domain (TM) and short cytoplasmic domain, (semaphorin) 4D*
53358	*SHC3*	*SHC (Src homology 2 domain containing) transforming protein 3*
4088	*SMAD3*	*SMAD family member 3*
83439	*TCF7L1*	*transcription factor 7-like 1 (T-cell specific, HMG-box)*
7035	*TFPI*	*tissue factor pathway inhibitor (lipoprotein-associated coagulation inhibitor)*
7042	*TGFB2*	*transforming growth factor, beta 2*
7448	*VTN*	*vitronectin*
51384	*WNT16*	*wingless-type MMTV integration site family, member 16*

Supplementary Table S3. Gene list in Figure 3E.

Entrez GeneID	*Symbol*	*Gene name*
595	*CCND1*	*cyclin D1*
1311	*COMP*	*cartilage oligomeric matrix protein*
4616	*GADD45B*	*growth arrest and DNA-damage-inducible, beta*
3486	*IGFBP3*	*insulin-like growth factor binding protein 3*
22801	*ITGA11*	*integrin, alpha 11*
3655	*ITGA6*	*integrin, alpha 6*
56034	*PDGFC*	*platelet derived growth factor C*
5054	*SERPINE1*	*serpin peptidase inhibitor, clade E (plasminogen activator inhibitor type 1), member 1*
3371	*TNC*	*tenascin C*

Supplementary Table S4. Gene list in G1 categorized in Figure 4A.

[hOFs = hOF-iPSCs > hDFs (58 genes)]

Entrez GeneID	*Symbol*	*Gene name*	hOFs*	hDFs*	hOF-iPSCs*
ECM/Secreted					
652	*BMP4*	*bone morphogenetic protein 4*	1,145.64	171.93	723.07
5764	*PTN*	*pleiotrophin*	445.93	108.86	236.02
6414	*SEPP1*	*selenoprotein P, plasma, 1*	566.50	162.79	581.10
Membrane protein					
928	*CD9*	*CD9 molecule*	1,765.96	302.50	2,569.37
54805	*CNNM2*	*cyclin M2*	621.14	260.96	473.88
286097	*EFHA2*	*EF-hand domain family, member A2*	233.76	110.00	161.69
2719	*GPC3*	*glypican 3*	1,148.59	83.85	2,052.12
182	*JAG1*	*jagged 1*	572.88	201.35	506.70
154141	*MBOAT1*	*membrane bound O-acyltransferase domain containing 1*	723.38	191.11	1,087.47
81832	*NETO1*	*neuropilin (NRP) and tolloid (TLL)-like 1*	197.37	52.57	261.25
22871	*NLGN1*	*neuroligin 1*	428.97	95.37	256.63
10507	*SEMA4D*	*sema domain, immunoglobulin domain (Ig), transmembrane domain (TM) and short cytoplasmic domain, (semaphorin) 4D*	322.63	92.17	609.81
Receptor					
1909	*EDNRA*	*endothelin receptor type A*	627.40	101.39	318.24
1910	*EDNRB*	*endothelin receptor type B*	830.53	48.39	777.82
2149	*F2R*	*coagulation factor II (thrombin) receptor*	840.23	243.10	422.44
51704	*GPRC5B*	*G protein-coupled receptor, family C, group 5, member B*	3,062.22	331.04	4,258.31
3949	*LDLR*	*low density lipoprotein receptor*	2,242.41	1,100.47	1,697.41
10200	*MPHOSPH6*	*M-phase phosphoprotein 6*	199.15	96.47	380.36
23596	*OPN3*	*opsin 3*	522.00	254.57	295.57
5638	*PRRG1*	*proline rich Gla (G-carboxyglutamic acid) 1*	382.29	167.54	348.33
5727	*PTCH1*	*patched 1*	1,042.34	373.70	1,736.94
154091	*SLC2A12*	*solute carrier family 2 (facilitated glucose transporter), member 12*	603.62	58.76	318.58
Enzyme					
51363	*CHST15*	*carbohydrate (N-acetylgalactosamine 4-sulfate 6-O) sulfotransferase 15*	530.65	190.96	309.00
1717	*DHCR7*	*7-dehydrocholesterol reductase*	1,567.48	737.66	1,807.00
2053	*EPHX2*	*epoxide hydrolase 2, cytoplasmic*	133.74	58.30	90.70
55224	*ETNK2*	*ethanolamine kinase 2*	793.70	268.64	718.60
8630	*HSD17B6*	*hydroxysteroid (17-beta) dehydrogenase 6 homolog (mouse)*	146.90	48.68	115.49
25840	*METTL7A*	*methyltransferase like 7A*	279.46	103.78	188.35
221692	*PHACTR1*	*phosphatase and actin regulator 1*	293.74	133.44	179.63

9262	*STK17B*	*serine/threonine kinase 17b*	1,707.03	525.32	908.08
Signaling					
9590	*AKAP12*	*A kinase (PRKA) anchor protein 12*	558.88	101.52	675.64
408	*ARRB1*	*arrestin, beta 1*	1,816.62	464.48	1,062.94
9829	*DNAJC6*	*DnaJ (Hsp40) homolog, subfamily C, member 6*	244.47	100.57	131.13
9732	*DOCK4*	*dedicator of cytokinesis 4*	299.23	89.40	394.20
25827	*FBXL2*	*F-box and leucine-rich repeat protein 2*	387.80	142.04	196.52
3485	*IGFBP2*	*insulin-like growth factor binding protein 2, 36kDa*	3,214.92	345.69	1,837.77
90293	*KLHL13*	*kelch-like 13 (Drosophila)*	118.70	43.03	159.32
9079	*LDB2*	*LIM domain binding 2*	1,260.05	428.25	800.85
114876	*OSBPL1A*	*oxysterol binding protein-like 1A*	385.91	187.71	530.29
5287	*PIK3C2B*	*phosphoinositide-3-kinase, class 2, beta polypeptide*	248.11	114.91	243.96
54477	*PLEKHA5*	*pleckstrin homology domain containing, family A member 5*	544.34	173.03	1,062.80
5997	*RGS2*	*regulator of G-protein signaling 2, 24kDa*	606.02	96.03	456.93
Transcriptional regulation					
2114	*ETS2*	*v-ets erythroblastosis virus E26 oncogene homolog 2 (avian)*	740.82	348.60	621.02
51804	*SIX4*	*SIX homeobox 4*	825.37	399.69	1,327.50
56849	*TCEAL7*	*transcription elongation factor A (SII)-like 7*	353.00	175.74	221.59
83439	*TCF7L1*	*transcription factor 7-like 1 (T-cell specific, HMG-box)*	1,981.90	829.81	1,863.20
7088	*TLE1*	*transducin-like enhancer of split 1 (E(sp1) homolog, Drosophila)*	830.79	319.75	1,129.28
9760	*TOX*	*thymocyte selection-associated high mobility group box*	1,289.94	301.64	782.68
Others					
81563	*C1orf21*	*chromosome 1 open reading frame 21*	1,799.54	718.36	1,488.53
81624	*DIAPH3*	*diaphanous homolog 3 (Drosophila)*	361.94	156.90	617.43
7802	*DNALI1*	*dynein, axonemal, light intermediate chain 1*	617.56	265.48	597.25
54536	*EXOC6*	*exocyst complex component 6*	143.21	70.12	166.65
83641	*FAM107B*	*family with sequence similarity 107, member B*	437.79	211.14	347.81
221303	*FAM162B*	*family with sequence similarity 162, member B*	1,349.86	576.11	818.38
256227	*STEAP1B*	*STEAP family member 1B*	359.74	144.26	402.06
54970	*TTC12*	*tetratricopeptide repeat domain 12*	241.10	95.59	175.52
125488	*TTC39C*	*tetratricopeptide repeat domain 39C*	1,445.40	530.95	908.84
57507	*ZNF608*	*zinc finger protein 608*	473.56	147.91	815.54

***The numbers indicate average signal values in each cell type.**

Supplementary Table S5. Gene list in G2 categorized in Figure 4A.

[hOFs > hOF-iPSCs = hDFs (103 genes)]

Entrez GeneID	*Symbol*	*Gene name*	hOFs*	hDFs*	hOF-iPSCs*
ECM/Secreted					
170689	*ADAMTS15*	*ADAM metallopeptidase with thrombospondin type 1 motif, 15*	1,002.73	147.39	119.07
9547	*CXCL14*	*chemokine (C-X-C motif) ligand 14*	935.32	229.85	231.33
58191	*CXCL16*	*chemokine (C-X-C motif) ligand 16*	371.76	125.23	126.61
25975	*EGFL6*	*EGF-like-domain, multiple 6*	497.45	88.14	101.46
2201	*FBN2*	*fibrillin 2*	5,342.37	446.65	225.84
8817	*FGF18*	*fibroblast growth factor 18*	1,140.65	270.03	164.82
2277	*FIGF*	*c-fos induced growth factor (vascular endothelial growth factor D)*	92.12	40.63	36.24
342035	*GLDN*	*gliomedin*	164.76	65.80	54.88
3082	*HGF*	*hepatocyte growth factor (hepapoietin A; scatter factor)*	252.34	57.54	44.97
4685	*NCAM2*	*neural cell adhesion molecule 2*	143.67	67.59	52.89
5179	*PENK*	*proenkephalin*	2,914.14	175.21	103.79
5228	*PGF*	*placental growth factor*	1,484.07	214.93	119.91
284654	*RSPO1*	*R-spondin 1*	698.57	291.67	148.91
340419	*RSPO2*	*R-spondin 2*	260.65	81.29	66.31
6405	*SEMA3F*	*sema domain, immunoglobulin domain (Ig), short basic domain, secreted, (semaphorin) 3F*	575.91	228.16	245.48
51384	*WNT16*	*wingless-type MMTV integration site family, member 16*	211.59	99.22	69.88
Membrane protein					
54805	*CNNM2*	*cyclin M2*	621.14	260.96	473.88
10584	*COLEC10*	*collectin sub-family member 10 (C-type lectin)*	137.68	59.88	48.13
2039	*EPB49*	*erythrocyte membrane protein band 4.9 (dematin)*	310.87	133.16	77.72
3383	*ICAM1*	*intercellular adhesion molecule 1*	579.56	246.95	160.73
223117	*SEMA3D*	*sema domain, immunoglobulin domain (Ig), short basic domain, secreted, (semaphorin) 3D*	932.65	244.67	221.81
56241	*SUSD2*	*sushi domain containing 2*	424.90	177.73	138.88
222865	*TMEM130*	*transmembrane protein 130*	1,224.19	358.83	218.42
219623	*TMEM26*	*transmembrane protein 26*	153.13	58.15	51.67
11045	*UPK1A*	*uroplakin 1A*	270.13	108.42	107.83
Receptor					
2044	*EPHA5*	*EPH receptor A5*	195.17	52.39	46.50
2051	*EPHB6*	*EPH receptor B6*	901.41	234.08	196.97
2149	*F2R*	*coagulation factor II (thrombin) receptor*	840.23	243.10	422.44
2151	*F2RL2*	*coagulation factor II (thrombin) receptor-like 2*	1,388.20	97.04	106.69
2828	*GPR4*	*G protein-coupled receptor 4*	339.03	168.19	109.05

3949	*LDLR*	*low density lipoprotein receptor*	2,242.41	1,100.47	1,697.41
8013	*NR4A3*	*nuclear receptor subfamily 4, group A, member 3*	812.63	175.44	93.30
23596	*OPN3*	*opsin 3*	522.00	254.57	295.57
6092	*ROBO2*	*roundabout, axon guidance receptor, homolog 2 (Drosophila)*	871.92	72.79	81.39
1903	*S1PR3*	*sphingosine-1-phosphate receptor 3*	486.04	222.20	177.63
57559	*STAMBPL1*	*STAM binding protein-like 1*	1,331.74	246.44	151.22
7098	*TLR3*	*toll-like receptor 3*	264.38	102.71	81.30
Channel					
54102	*CLIC6*	*chloride intracellular channel 6*	333.86	140.65	149.92
286097	*EFHA2 (=MICU3)*	*EF-hand domain family, member A2*	233.76	110.00	161.69
3788	*KCNS2*	*potassium voltage-gated channel, delayed-rectifier, subfamily S, member 2*	384.36	157.62	107.72
6335	*SCN9A*	*sodium channel, voltage-gated, type IX, alpha subunit*	594.07	109.09	109.71
Transport					
9829	*DNAJC6 (auxilin)*	*DnaJ (Hsp40) homolog, subfamily C, member 6*	244.47	100.57	131.13
30845	*EHD3*	*EH-domain containing 3*	1,716.78	695.62	358.06
30061	*SLC40A1*	*solute carrier family 40 (iron-regulated transporter), member 1*	220.16	86.22	60.44
28232	*SLCO3A1*	*solute carrier organic anion transporter family, member 3A1*	1,871.92	630.79	683.84
64220	*STRA6*	*stimulated by retinoic acid gene 6 homolog (mouse)*	426.14	170.43	142.68
Enzyme					
81792	*ADAMTS12*	*ADAM metallopeptidase with thrombospondin type 1 motif, 12*	1,039.43	355.23	310.06
126	*ADH1C*	*alcohol dehydrogenase 1C (class I), gamma polypeptide*	196.14	82.88	43.81
217	*ALDH2*	*aldehyde dehydrogenase 2 family (mitochondrial)*	2,581.97	1,040.36	1,137.16
415	*ARSE*	*arylsulfatase E (chondrodysplasia punctata 1)*	567.49	176.13	273.43
834	*CASP1*	*caspase 1, apoptosis-related cysteine peptidase*	139.16	47.90	26.82
51363	*CHST15*	*carbohydrate (N-acetylgalactosamine 4-sulfate 6-O) sulfotransferase 15*	530.65	190.96	309.00
2053	*EPHX2*	*epoxide hydrolase 2, cytoplasmic*	133.74	58.30	90.70
2138	*EYA1*	*eyes absent homolog 1 (Drosophila)*	693.37	84.87	117.43
2326	*FMO1*	*flavin containing monooxygenase 1*	88.92	36.71	31.44
3294	*HSD17B2*	*hydroxysteroid (17-beta) dehydrogenase 2*	309.54	94.48	72.46
11185	*INMT*	*indolethylamine N-methyltransferase*	499.36	206.20	109.09
57134	*MAN1C1*	*mannosidase, alpha, class 1C, member 1*	813.28	304.28	206.89
25840	*METTL7A*	*methyltransferase like 7A*	279.46	103.78	188.35
2185	*PTK2B*	*PTK2B protein tyrosine kinase 2 beta*	1,029.69	234.43	124.39
401494	*PTPLAD2*	*protein tyrosine phosphatase-like A domain containing 2*	625.76	236.72	143.25

9262	*STK17B*	*serine/threonine kinase 17b*	1,707.03	525.32	908.08
11274	*USP18*	*ubiquitin specific peptidase 18*	800.73	298.52	284.62
Signaling					
57569	*ARHGAP20*	*Rho GTPase activating protein 20*	178.88	86.49	47.74
9411	*ARHGAP29*	*Rho GTPase activating protein 29*	627.56	260.05	150.02
56892	*C8orf4*	*chromosome 8 open reading frame 4*	168.84	82.94	69.87
154043	*CNKSR3*	*CNKSR family member 3*	460.36	144.04	113.63
25827	*FBXL2=SCF*	*F-box and leucine-rich repeat protein 2*	387.80	142.04	196.52
10586	*MAB21L2*	*mab-21-like 2 (C. elegans)*	1,108.96	87.40	58.62
117583	*PARD3B*	*par-3 partitioning defective 3 homolog B (C. elegans)*	478.38	221.64	172.10
221692	*PHACTR1*	*phosphatase and actin regulator 1*	293.74	133.44	179.63
5738	*PTGFRN*	*prostaglandin F2 receptor negative regulator*	1,011.31	460.16	482.20
5920	*RARRES3*	*retinoic acid receptor responder (tazarotene induced) 3*	822.85	183.22	122.87
387496	*RASL11A*	*RAS-like, family 11, member A*	562.03	109.31	110.51
9770	*RASSF2*	*Ras association (RalGDS/AF-6) domain family member 2*	2,222.80	511.12	353.93
83937	*RASSF4*	*Ras association (RalGDS/AF-6) domain family member 4*	844.54	133.25	179.19
6000	*RGS7*	*regulator of G-protein signaling 7*	341.54	76.01	104.05
83853	*ROPN1L*	*rhophilin associated tail protein 1-like*	763.00	225.85	123.32
8991	*SELENBP1*	*selenium binding protein 1*	2,774.32	878.88	659.08
53358	*SHC3*	*SHC (Src homology 2 domain containing) transforming protein 3*	797.94	209.13	250.88
7035	*TFPI*	*tissue factor pathway inhibitor (lipoprotein-associated coagulation inhibitor)*	411.99	123.24	69.91
Transcriptional regulation					
1749	*DLX5*	*distal-less homeobox 5*	418.74	106.42	81.89
2114	*ETS2*	*v-ets erythroblastosis virus E26 oncogene homolog 2 (avian)*	740.82	348.60	621.02
2294	*FOXF1*	*forkhead box F1*	768.86	182.83	101.53
9079	*LDB2*	*LIM domain binding 2*	1,260.05	428.25	800.85
431707	*LHX8*	*LIM homeobox 8*	735.18	68.93	57.84
4286	*MITF*	*microphthalmia-associated transcription factor*	227.47	111.40	103.55
5083	*PAX9*	*paired box 9*	4,117.50	102.03	75.43
5307	*PITX1*	*paired-like homeodomain 1*	1,039.93	281.68	163.81
5468	*PPARG*	*peroxisome proliferator-activated receptor gamma*	524.44	100.81	62.96
56849	*TCEAL7*	*transcription elongation factor A (SII)-like 7*	353.00	175.74	221.59
Others					
147463	*ANKRD29*	*ankyrin repeat domain 29*	410.47	139.90	97.52
83938	*C10orf11*	*chromosome 10 open reading frame 11*	323.62	108.12	60.18
152078	*C3orf55*	*chromosome 3 open reading frame 55*	379.27	166.05	130.17

83641	*FAM107B*	*family with sequence similarity 107, member B*	437.79	211.14	347.81
221303	*FAM162B*	*family with sequence similarity 162, member B*	1,349.86	576.11	818.38
54855	*FAM46C*	*family with sequence similarity 46, member C*	326.17	95.40	89.89
144363	*LYRM5*	*LYR motif containing 5*	1,026.89	437.41	289.32
57523	*NYNRIN*	*NYN domain and retroviral integrase containing*	1,838.88	532.23	388.31
22874	*PLEKHA6*	*pleckstrin homology domain containing, family A member 6*	723.64	253.54	247.55
54970	*TTC12*	*tetratricopeptide repeat domain 12*	241.10	95.59	175.52
125488	*TTC39C*	*tetratricopeptide repeat domain 39C*	1,445.40	530.95	908.84
51186	*WBP5*	*WW domain binding protein 5*	550.84	181.33	200.36

***The numbers indicate average signal values in each cell type.**

Supplementary Table S6. Gene list in G3 categorized in Figure 4A.

[hDFs > hOFs = hOF-iPSCs (70 genes)]

Entrez GeneID	*Symbol*	*Gene name*	hOFs*	hDFs*	hOF-iPSCs*
ECM/Secreted					
51129	*ANGPTL4*	*angiopoietin-like 4*	157.23	322.41	114.71
392255	*GDF6*	*growth differentiation factor 6*	110.65	320.69	82.52
83729	*INHBE*	*inhibin, beta E*	101.29	361.81	131.59
3885	*KRT34*	*keratin 34*	96.51	396.44	49.84
56034	*PDGFC*	*platelet derived growth factor C*	175.70	502.13	123.82
11341	*SCRG1*	*stimulator of chondrogenesis 1*	66.24	143.64	45.59
7292	*TNFSF4*	*tumor necrosis factor (ligand) superfamily, member 4*	73.65	407.97	73.64
Membrane protein					
3084	*NRG1*	*neuregulin 1*	194.47	401.57	123.72
8828	*NRP2*	*neuropilin 2*	163.95	502.96	290.66
4908	*NTF3*	*neurotrophin 3*	93.99	292.12	61.57
4978	*OPCML*	*opioid binding protein/cell adhesion molecule-like*	66.32	239.11	126.11
8482	*SEMA7A*	*semaphorin 7A, GPI membrane anchor (John Milton Hagen blood group)*	368.52	1096.90	339.94
80329	*ULBP1*	*UL16 binding protein 1*	226.29	838.48	161.63
Receptor					
150	*ADRA2A*	*adrenoceptor alpha 2A*	358.04	807.06	253.66
9568	*GABBR2*	*gamma-aminobutyric acid (GABA) B receptor, 2*	190.81	439.48	170.06
2861	*GPR37*	*G protein-coupled receptor 37 (endothelin receptor type B-like)*	81.05	186.10	145.51
2898	*GRIK2*	*glutamate receptor, ionotropic, kainate 2*	56.26	126.45	60.08
5798	*PTPRN*	*protein tyrosine phosphatase, receptor type, N*	167.46	864.93	171.57
51330	*TNFRSF12A*	*tumor necrosis factor receptor superfamily, member 12A*	1814.14	4302.70	1907.53
219699	*UNC5B*	*unc-5 homolog B (C. elegans)*	668.99	2425.98	574.30
Enzyme					
978	*CDA*	*cytidine deaminase*	134.37	474.77	238.77
9023	*CH25H*	*cholesterol 25-hydroxylase*	130.93	1883.66	160.70
11072	*DUSP14*	*dual specificity phosphatase 14*	437.06	1031.69	322.69
2026	*ENO2*	*enolase 2 (gamma, neuronal)*	351.59	948.42	640.23
3037	*HAS2*	*hyaluronan synthase 2*	306.76	1542.76	217.43
60676	*PAPPA2*	*pappalysin 2*	77.98	227.62	68.48
5587	*PRKD1*	*protein kinase D1*	281.49	821.26	210.26
8710	*SERPINB7*	*serpin peptidase inhibitor, clade B (ovalbumin), member 7*	40.55	161.10	29.01
Signaling					
9472	*AKAP6*	*A kinase (PRKA) anchor protein 6*	96.41	228.78	64.73
10123	*ARL4C*	*ADP-ribosylation factor-like 4C*	150.13	331.18	220.70
595	*CCND1*	*cyclin D1*	854.39	1845.44	1093.25
117248	*GALNTL2*	*UDP-N-acetyl-alpha-D-galactosamine:polypeptide N-acetylgalactosaminyltransferase-like 2*	78.33	304.28	54.37

80000	*GREB1L*	*growth regulation by estrogen in breast cancer-like*	68.39	149.22	49.06
81851	*KRTAP1-1*	*keratin associated protein 1-1*	407.75	1030.52	212.39
81872	*KRTAP2-1*	*keratin associated protein 2-1*	963.09	2000.59	488.66
29995	*LMCD1*	*LIM and cysteine-rich domains 1*	470.47	1885.54	467.76
4642	*MYO1D*	*myosin ID*	787.51	1867.04	610.42
57451	*ODZ2*	*odz, odd Oz/ten-m homolog 2 (Drosophila)*	120.85	2989.18	82.22
57381	*RHOJ*	*ras homolog family member J*	110.27	733.84	85.10
Transcriptional regulation					
646	*BNC1*	*basonuclin 1*	110.92	302.91	115.19
2119	*ETV5*	*ets variant 5*	278.62	753.87	316.87
3201	*HOXA4*	*homeobox A4*	56.22	197.06	47.74
3203	*HOXA6*	*homeobox A6*	124.56	251.45	94.94
3204	*HOXA7*	*homeobox A7*	97.80	443.06	94.46
3205	*HOXA9*	*homeobox A9*	109.45	453.34	76.16
3212	*HOXB2*	*homeobox B2*	104.86	949.20	92.03
3213	*HOXB3*	*homeobox B3*	95.23	504.78	72.78
3215	*HOXB5*	*homeobox B5*	61.76	186.66	49.10
3216	*HOXB6*	*homeobox B6*	66.54	375.16	50.91
3217	*HOXB7*	*homeobox B7*	56.39	125.71	42.66
3218	*HOXB8*	*homeobox B8*	109.84	301.85	90.79
3219	*HOXB9*	*homeobox B9*	115.73	759.22	87.43
3226	*HOXC10*	*homeobox C10*	80.33	1175.04	59.24
3222	*HOXC5*	*homeobox C5*	46.06	231.32	41.30
3223	*HOXC6*	*homeobox C6*	72.55	771.85	59.02
3224	*HOXC8*	*homeobox C8*	119.99	1081.51	77.57
3225	*HOXC9*	*homeobox C9*	62.23	432.30	51.29
3234	*HOXD8*	*homeobox D8*	138.92	341.93	75.36
3235	*HOXD9*	*homeobox D9*	172.26	377.58	123.78
56956	*LHX9*	*LIM homeobox 9*	95.70	601.44	67.02
137814	*NKX2-6*	*NK2 homeobox 6*	137.03	388.34	103.74
9792	*SERTAD2*	*SERTA domain containing 2*	320.00	822.43	186.38
6910	*TBX5*	*T-box 5*	118.86	770.39	76.33
miRNA					
400765	*MIR137HG*	*MIR137 host gene (non-protein coding)*	121.41	256.82	76.12
406973	*MIR196A2*	*microRNA 196a-2*	53.73	126.24	47.60
Others					
25841	*ABTB2*	*ankyrin repeat and BTB (POZ) domain containing 2*	186.86	390.65	186.25
79870	*BAALC*	*brain and acute leukemia, cytoplasmic*	112.21	237.19	88.72
285761	*DCBLD1*	*discoidin, CUB and LCCL domain containing 1*	186.00	447.59	181.15
54757	*FAM20A*	*family with sequence similarity 20, member A*	140.73	475.58	163.94
196051	*PPAPDC1A*	*phosphatidic acid phosphatase type 2 domain containing 1A*	171.52	736.63	135.56

***The numbers indicate average signal values in each cell type.**

Supplementary Table S7. Gene list in G4 categorized in Figure 4A.
[hDFs = hOF-iPSCs > hOFs (22 genes)]

Entrez GeneID	*Symbol*	*Gene name*	hOFs*	hDFs*	hOF-iPSCs*
Membrane protein					
1948	*EFNB2*	*ephrin-B2*	61.51	255.89	164.79
2861	*GPR37*	*G protein-coupled receptor 37 (endothelin receptor type B-like)*	81.05	186.10	145.51
2890	*GRIA1*	*glutamate receptor, ionotropic, AMPA 1*	86.27	375.72	194.07
58494	*JAM2*	*junctional adhesion molecule 2*	284.11	1189.57	649.12
4978	*OPCML*	*opioid binding protein/cell adhesion molecule-like*	66.32	239.11	126.11
84898	*PLXDC2*	*plexin domain containing 2*	114.84	831.44	1644.58
79845	*RNF122*	*ring finger protein 122*	226.50	469.62	509.37
6507	*SLC1A3*	*solute carrier family 1 (glial high affinity glutamate transporter), member 3*	87.69	223.11	205.04
Receptor					
8828	*NRP2*	*neuropilin 2*	163.95	502.96	290.66
114880	*OSBPL6*	*oxysterol binding protein-like 6*	100.30	204.24	265.24
Enzyme					
205	*AK4*	*adenylate kinase 4*	130.69	816.18	1043.56
219	*ALDH1B1*	*aldehyde dehydrogenase 1 family, member B1*	1367.53	2750.02	2787.63
481	*ATP1B1*	*ATPase, Na+/K+ transporting, beta 1 polypeptide*	154.65	326.04	580.63
978	*CDA*	*cytidine deaminase*	134.37	474.77	238.77
2026	*ENO2*	*enolase 2 (gamma, neuronal)*	351.59	948.42	640.23
25797	*QPCT*	*glutaminyl-peptide cyclotransferase*	126.52	422.84	293.24
Signaling					
79822	*ARHGAP28*	*Rho GTPase activating protein 28*	77.13	212.41	259.33
10123	*ARL4C*	*ADP-ribosylation factor-like 4C*	150.13	331.18	220.70
595	*CCND1*	*cyclin D1*	854.39	1845.44	1093.25
1600	*DAB1*	*disabled homolog 1 (Drosophila)*	90.64	424.81	291.18
55714	*ODZ3*	*odz, odd Oz/ten-m homolog 3 (Drosophila)*	154.87	746.81	1330.60
Others					
90768	*MGC45800*	*uncharacterized LOC90768*	137.47	344.63	381.19

***The numbers indicate average signal values in each cell type.**

Supplementary Table S8. Gene list in Figure 4D.

Entrez GeneID	*Symbol*	*Gene name*
2103	*ESRRB*	*estrogen-related receptor beta*
8928	*FOXH1*	*forkhead box H1*
148979	*GLIS1*	*GLIS family zinc finger 1*
79727	*LIN28A*	*lin-28 homolog A (C. elegans)*
53615	*MBD3*	*methyl-CpG binding domain protein 3*
55384	*MEG3*	*maternally expressed 3 (non-protein coding)*
79923	*NANOG*	*Nanog homeobox*
2494	*NR5A2*	*nuclear receptor subfamily 5, group A, member 2*
63978	*PRDM14*	*PR domain containing 14*
5916	*RARG*	*retinoic acid receptor, gamma*
57167	*SALL4*	*spalt-like transcription factor 4*
6926	*TBX3*	*T-box 3*