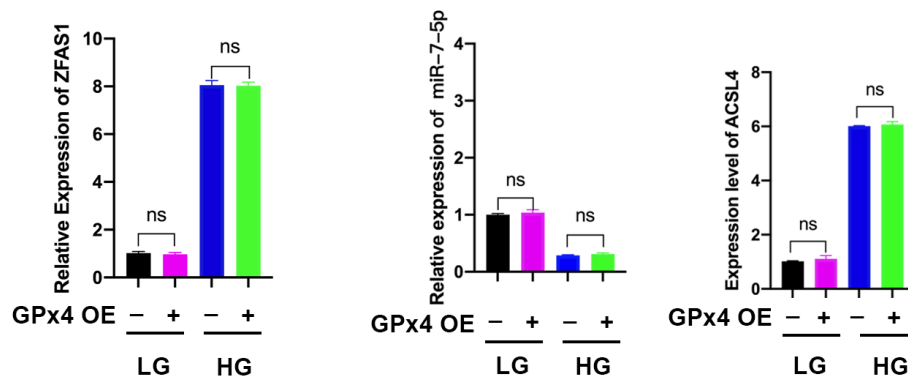


**Supplementary Figure 1** Identification of primarily cultured hRECs.

(A) Flow cytometric analysis of characteristic cell marker CD31. Red curves represent isotype controls for PE dye and blue curves represent measured endothelial marker CD31. (B) Primarily cultured cells at passage 1 stained positively for the endothelial cell marker CD31 (scale bar = 40  $\mu$ m).



**Supplementary Figure 2** The effects of GPx4 overexpression on ZFAS1/miR-7-5p/ACSL4 axis.

RT-qPCR results demonstrated that no detectable alteration was observed in ZFAS1, miR-7-5p, and ACSL4 expression level after GPx4 overexpression (GPx4 OE). GAPDH and miR-39-3p served as endogenous and exogenous normalization for ACSL4 and miR-7-5p detection, respectively. ns means not significant.

**Supplementary Table 1** RNA sequences and the primer sequences for RT-qPCR

<b>Oligonucleotide</b>	<b>Forward</b>	<b>Reverse</b>
mimic-NC	5'UUCUCCGAACGUGUCACGUTT-3'	
miR-7-5p mimic	5'UGGAAGACUAGUGAU UUUGUUGU-3'	5'AACAAAUCACUAGUCUCCA UU-3'
si-ACSL4	5'-TAGATATCAGTTGTGTAA-3'	

<b>Primer</b>	<b>Forward</b>	<b>Reverse</b>
ZFAS1	5'ACGTGCAGACATCTACAACCT3	5'TACTTCCAACACCCGCAT-3'
ACSL4	5'CATCCCTGGAGCAGATACTCT- 3'	5'TCACTTAGGATTTCCCTGGTCC- 3'
GAPDH	5'AGGTGAAGGTCGGAGTCAACG -3'	5'AGGGGTCATTGATGGCAACA-3'
U6	5'CTCGCTTCGGCAGCACATATAC T-3'	5'ACGCTTCACGAATTTGCGTGTC- 3'

**Supplementary Table 2** A total 108 dysregulated lncRNAs were identified between the CD31<sup>+</sup> endothelial cells isolated from nine fibrovascular membranes (FVM) samples and four control retinal samples without diabetes diagnosis using a differential gene expression analysis.

<b>Gen id</b>	<b>logFC</b>	<b>AveExpr</b>	<b>t</b>	<b>P.Value</b>	<b>B</b>
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DLGAP1-					7.6965537
AS3	-1.4710454	0.32849254	-10.757025	1.33E-07	6
FAM155A					4.7458838
-IT1	-2.9211402	0.78065509	-7.9044537	3.72E-06	3
DIO3OS					4.0160664
	-4.4987755	1.19044822	-7.3215001	8.17E-06	3
LINC0126					3.1526454
7	-4.3167197	1.09421478	-6.6779134	2.04E-05	7
LEMD1-					2.9416331
AS1	-1.4600016	0.44365662	-6.5273842	2.55E-05	9
ENTPD3-					2.7069293
AS1	-1.2735467	0.37366433	-6.3628158	3.26E-05	6
LINC0155					2.4843469
9	-3.71664	0.96429112	-6.2094107	4.12E-05	6
PWRN1					2.0916904
	-1.926368	0.39854217	-5.9447623	6.21E-05	3
LINC0151					2.0811043
1	-1.4352726	0.37756622	-5.9377284	6.28E-05	3
PLCE1-					1.5618519
AS2	-4.8388368	1.6898932	-5.5988212	0.00010762	5
CLIP1-					1.3532726
AS1	-2.5400884	0.81229483	-5.4658787	0.00013356	1

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LINC0123				0.00013880	1.3160339
1	-1.7238205	0.55908245	-5.4423255	5	4
FRY-AS1				0.00013963	1.3102414
	-3.3454689	1.16242564	-5.4386667	9	2
LINC0071				0.00023470	0.8073014
0	-1.4622803	0.40781713	-5.1257507	2	3
LINC0155				0.00030634	0.5487209
5	-4.4836692	1.64790877	-4.9683099	4	7
LINC0050				0.00034672	0.4284233
7	-1.6122581	0.3915245	-4.8958007	6	4
LINC0109				0.00038754	0.3202554
1	-1.1770119	0.4608682	-4.8309834	3	7
LHFPL3- AS2				0.00054311	-0.007996
	-2.5479843	0.67044479	-4.6363714	8	
CATIP- AS2				0.00058085	-0.0733644
	-2.7391397	0.69985332	-4.5979709	8	
SPATA41				0.00065916	-0.1964381
	-2.220901	0.72328936	-4.5259727	1	
ZFAS1			4.4686367	0.00072934	-0.2949156
	3.75670016	4.26267847	3	2	
ZNF252P- AS1				0.00081582	-0.4039868
	-1.9932482	0.58966903	-4.4054046		

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TGFB2-				0.00141060	
	-1.7759999	0.6270409	-4.1001359		-0.9369247
OT1				4	
LINC0113				0.00153134	
	-3.5890891	1.27942644	-4.054843		-1.016815
2				4	
MIF-AS1			4.0226804	0.00162351	
	2.92044245	3.10096112			-1.0736603
			7	7	
COLCA1				0.00190142	
	-1.7823379	0.74214159	-3.9360194		-1.227278
				4	
LINC0099				0.00264395	
	-3.4418831	1.32645915	-3.7564406		-1.5474482
4				3	
LINC0128				0.00278985	
	-4.0875048	1.77950551	-3.7273242		-1.5995609
9				8	
CASC20				0.00298667	
	-3.5954107	1.38027106	-3.690425		-1.6656721
				7	
C8orf49				0.00313556	
	-4.6300025	2.4551697	-3.6641287		-1.7128301
				0.00327039	
TCL6					-1.753633
	-3.8442528	1.54240611	-3.6413913		
				9	
LINC0136				0.00437624	
	-2.9911909	0.92518848	-3.4846101		-2.0355345
0				9	
MIR22HG			3.3604403	0.00551730	
	3.9007892	3.94647777			-2.2592219
			9	6	

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WDR11-				0.00560175	
AS1	-3.2199691	1.70159224	-3.3523134	4	-2.2738673
ERVK13-			3.3313100	0.00582610	
1	2.30362055	4.1505639	8	8	-2.3117165
KRBOX1-				0.00601017	
AS1	-1.7762186	0.70401075	-3.3146805	2	-2.3416832
SORCS3-				0.00625741	
AS1	-1.6284024	0.74873236	-3.2931348	9	-2.3805065
LINC0087				0.00708806	
0	-3.5484501	1.60596279	-3.2265699	2	-2.5004138
WDFY3-				0.00719560	
AS2	-1.5824012	0.65104239	-3.2185327	3	-2.5148863
LINC0152				0.00908461	
0	-1.0593642	0.30147837	-3.0941926	3	-2.7385254
LINC0047				0.00950941	
1	-2.0278403	0.96270184	-3.0698271	6	-2.7822735
SLC39A1				0.01000093	
2-AS1	-1.853533	0.50693687	-3.0429587	8	-2.8304781
LINC0070					
7	-3.9863704	2.78169011	-3.0199029	0.01044291	-2.8718081
GAS5			2.9939470	0.01096385	
	3.67090603	3.96884949	2	2	-2.9182953

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LINC0093				0.01119706	
0	-1.7437713	0.88717996	-2.9827235	4	-2.9383821
LINC0069				0.01126781	
1	-1.2761787	0.66753253	-2.9793645	6	-2.9443919
LINC0029				0.01133807	
9	-2.4687919	1.4208337	-2.9760496	6	-2.950322
TMCC1-				0.01246928	
AS1	-3.4730649	1.82214051	-2.9253233	9	-3.0409593
NAV2-				0.01409059	
AS5	-4.0061997	2.55890654	-2.8600782	3	-3.1572038
DNAJC9-				0.01418651	
AS1	-1.692498	0.74530722	-2.8564551	3	-3.1636466
LINC0015				0.01437333	
8	-2.2446696	1.30936031	-2.8494676	7	-3.1760685
LINC0090				0.01464060	
1	-2.0512018	1.14524051	-2.8396262	3	-3.193555
CEBPB-				0.01470588	
AS1	-2.8502869	1.59329985	-2.8372493	6	-3.1977767
C8orf31				0.01562563	
	-2.7555551	0.7931688	-2.8048286	1	-3.2552983
LINC0046				0.01571546	
2	-1.3924286	0.35271905	-2.8017637	5	-3.2607298

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LINC0055				0.01608420	
0	-2.5160656	1.66399517	-2.7893621	3	-3.2826962
LINC0060				0.01639085	
6	-3.2198475	1.69891621	-2.7792604	6	-3.3005751
LINC0129				0.01749377	
9	-3.4557692	2.51204606	-2.7444078	4	-3.3621609
LINC0065				0.01777468	
2	-2.0189293	0.51893776	-2.7358769	4	-3.3772111
LINC0151				0.01800116	
6	-1.7616249	0.92262286	-2.729095	3	-3.3891685
LINC-				0.01854302	
PINT	3.20856617	2.94040549	2.7132037	5	-3.4171622
LINC0120				0.01868445	
4	-1.696483	0.82943962	-2.7091311	1	-3.4243306
EGFLAM					
-AS2	-2.8778582	1.82633626	-2.6927913	0.01926261	-3.4530672
SNHG6	2.72830295	4.96389472	2.6921313	0.01928632	-3.4542269
			9	5	
LINC0091				0.02028999	
7	-2.9987067	0.839286	-2.6649083	9	-3.5020125
HCG11	-3.3183918	3.06540302	-2.6535198	0.02072489	-3.5219689
				9	

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LINC0092					
7	-3.2509643	1.75451787	-2.6198416	0.02206507	-3.5808622
DSG2-				0.02312801	
AS1	-1.6797904	0.64172906	-2.594522	9	-3.6250125
LINC0156				0.02321644	
1	-2.7690085	0.78478968	-2.5924672	4	-3.6285907
LINC0124				0.02371604	
7	-4.0670694	2.58861767	-2.5809988	3	-3.6485473
CACNA1				0.02385243	
C-AS4	-3.7199238	2.71771959	-2.5779088	6	-3.6539202
ERICH3-				0.02391546	
AS1	-3.0777581	1.9750823	-2.5764865	9	-3.6563927
ENTPD1-				0.02425815	
AS1	-3.5424245	2.78354374	-2.5688178	4	-3.6697177
LINC0096				0.02434696	
7	-4.1361636	2.61677851	-2.5668475	9	-3.6731395
GTF3C2-				0.02495069	
AS1	-2.2894118	0.93493783	-2.5536367	2	-3.6960638
THUMPD			2.5370906	0.02572740	
3-AS1	3.57162659	4.18358453	1	2	-3.7247292
LINC0048				0.02609769	
5	-2.1483497	1.27809691	-2.5293725	5	-3.7380824

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GPR1-AS	-2.162699	1.31894136	-2.5207087	0.02651952	-3.7530577
				3	
DDX11-				0.02673089	
AS1	-1.3521424	0.52816121	-2.5164176		-3.7604692
				3	
LARS2-				0.02678017	
AS1	-1.7354155	0.94717719	-2.5154218		-3.7621886
				6	
LINC0042				0.02742905	
6	-1.9647512	0.96796443	-2.5024741		-3.7845266
				8	
TUB-AS1				0.02768818	
	-3.3760009	2.04821534	-2.4973863		-3.793295
				7	
LINC0070				0.02797187	
1	-3.5311339	3.67608606	-2.4918689		-3.8027978
				7	
LINC0026				0.02849938	
9	-1.54763	0.5063354	-2.4817521		-3.8202056
				2	
NRSN2-				0.02931502	
AS1	-1.3433054	0.45008381	-2.4664604		-3.8464763
				5	
LINC0126				0.03073135	
6	-2.9083933	2.42264595	-2.4408585		-3.8903456
				4	
SNAP25-				0.03391195	
AS1	-1.8254407	0.69221126	-2.3872799		-3.9816688
				9	
LINC0155				0.03523027	
0	-1.3319192	0.54597387	-2.366477		-4.0169415
				4	

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CASC17	-2.5714905	1.23600414	-2.3462516	0.03655902	-4.0511311
LINC0027				0.03804246	
1	-2.0483918	1.31128128	-2.3244866		-4.0878055
				2	
HCG18	1.32947769	1.75037925	2.3158647	0.03864587	-4.102299
			6	3	
CLSTN2-				0.03879277	
AS1	-2.5807952	1.43979741	-2.3137852		-4.1057919
				9	
NAV2-				0.03934113	
AS4	-2.1910735	0.75067247	-2.3060884		-4.1187092
				8	
PROSER2				0.04353790	
-AS1	-2.3186002	1.43534106	-2.250357		-4.2117522
				4	
LINC0084					
2	-3.1482492	2.67402138	-2.2421609	0.04418988	-4.2253606
FGD5-			2.2363742	0.04465575	
AS1	2.09601714	4.26070488			-4.2349565
			8	8	
IGF2BP2-					
AS1	-1.2642556	0.72709584	-2.2349325	0.04477256	-4.237346
PTCSC3	-2.0227407	1.27536807	-2.2234661	0.04571181	-4.2563263
				7	
PTPRD-				0.04580006	
AS2	-2.8191703	1.59303051	-2.2224004		-4.2580885
				1	

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FAM225A	2.46007457	2.18305474	2.2159147	0.04634054	-4.2688045
			6	1	
SNHG16	2.61728865	5.51067429	2.2105117	0.04679540	-4.2777221
			6	6	
SMAD5- AS1	-1.6294541	0.61056571	-2.2063384	0.04714963	-4.284604
				6	
LINC0120	-4.7424641	3.95644796	-2.1878765	0.04874728	-4.3149834
6				7	
LINC0084	-2.5988943	1.84129049	-2.1871159	0.04881419	-4.3162327
0				1	
TMEM72- AS1	-1.0542429	0.55922908	-2.1867444	0.04884690	-4.3168429
				2	
C3orf35	-3.3280128	2.66326454	-2.178812	0.04955027	-4.3298601
				9	
NUTM2B -AS1	2.3553037	3.76727381	2.1757448	0.04982480	-4.3348881
			5	4	

**Supplementary Table 3** A total of 69 miRNAs were identified to interact with ZFAS1 using starBase database.

miRNAid	miRNAname	geneID	start	end
MIMAT000069	hsa-miR-	ENSG0000017741		
0	296-5p	0	47894715	47894724

MIMAT001969	hsa-miR-	ENSG0000017741		
9	4640-5p	0	47894729	47894751
MIMAT001984	hsa-miR-	ENSG0000017741		
5	4726-5p	0	47894729	47894751
MIMAT000075	hsa-miR-	ENSG0000017741		
8	135b-5p	0	47895147	47895174
MIMAT000042	hsa-miR-	ENSG0000017741		
8	135a-5p	0	47895149	47895174
MIMAT000329	hsa-miR-	ENSG0000017741		
3	624-5p	0	47895192	47895212
MIMAT002102	hsa-miR-	ENSG0000017741		
0	5000-3p	0	47895225	47895251
MIMAT000587	hsa-miR-	ENSG0000017741		
7	1286	0	47895227	47895252
MIMAT001895	hsa-miR-	ENSG0000017741		
2	4436a	0	47895229	47895251
MIMAT000331	hsa-miR-	ENSG0000017741		
2	642a-5p	0	47895660	47895684
MIMAT000281	hsa-miR-	ENSG0000017741		
4	432-5p	0	47895684	47895704
MIMAT000481	hsa-miR-	ENSG0000017741		
4	654-3p	0	47895701	47895722

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MIMAT000481	hsa-miR-	ENSG0000017741	47895711	47895722
4	654-3p	0		
MIMAT001819	hsa-miR-	ENSG0000017741	47897079	47897100
9	3924	0		
MIMAT000009	hsa-miR-96-	ENSG0000017741	47897098	47897122
5	5p	0		
MIMAT000579	hsa-miR-	ENSG0000017741	47897098	47897122
6	1271-5p	0		
MIMAT000025	hsa-miR-7-	ENSG0000017741	47897110	47897132
2	5p	0		
MIMAT000497	hsa-miR-934	ENSG0000017741	47897123	47897146
7		0		
MIMAT000283	hsa-miR-	ENSG0000017741	47897138	47897158
3	520a-5p	0		
MIMAT000283	hsa-miR-	ENSG0000017741	47897138	47897158
8	525-5p	0		
MIMAT001970	hsa-miR-	ENSG0000017741	47897143	47897164
0	4640-3p	0		
MIMAT000333	hsa-miR-421	ENSG0000017741	47897246	47897272
9		0		
MIMAT000045	hsa-miR-	ENSG0000017741	47897271	47897292
9	193a-3p	0		

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MIMAT000281	hsa-miR-	ENSG0000017741		
9	193b-3p	0	47897273	47897292
MIMAT000591	hsa-miR-	ENSG0000017741		
9	548o-3p	0	47897274	47897296
MIMAT000579	hsa-miR-	ENSG0000017741		
5	1323	0	47897275	47897296
MIMAT001980	hsa-miR-	ENSG0000017741		
1	4703-5p	0	47897340	47897365
MIMAT001835	hsa-miR-	ENSG0000017741		
8	3942-5p	0	47897344	47897365
MIMAT001498	hsa-miR-	ENSG0000017741		
3	3121-3p	0	47897373	47897394
MIMAT000045	hsa-miR-	ENSG0000017741		
1	150-5p	0	47897429	47897448
MIMAT000283	hsa-miR-	ENSG0000017741		
4	520a-3p	0	47897666	47897691
MIMAT000072	hsa-miR-	ENSG0000017741		
4	372-3p	0	47897667	47897691
MIMAT000068	hsa-miR-	ENSG0000017741		
4	302a-3p	0	47897669	47897691
MIMAT000071	hsa-miR-	ENSG0000017741		
5	302b-3p	0	47897669	47897691

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MIMAT000071	hsa-miR-	ENSG0000017741	47897669	47897691
7	302c-3p	0		
MIMAT000071	hsa-miR-	ENSG0000017741	47897669	47897691
8	302d-3p	0		
MIMAT000072	hsa-miR-	ENSG0000017741	47897670	47897691
6	373-3p	0		
MIMAT000285	hsa-miR-	ENSG0000017741	47897670	47897691
6	520d-3p	0		
MIMAT000282	hsa-miR-	ENSG0000017741	47897671	47897691
5	520e	0		
MIMAT000284	hsa-miR-	ENSG0000017741	47897671	47897691
6	520c-3p	0		
MIMAT000284	hsa-miR-	ENSG0000017741	47897672	47897691
3	520b	0		
MIMAT000593	hsa-miR-	ENSG0000017741	47897675	47897691
1	302e	0		
MIMAT000283	hsa-miR-	ENSG0000017741	47905597	47905617
8	525-5p	0		
MIMAT000283	hsa-miR-	ENSG0000017741	47905599	47905617
3	520a-5p	0		
MIMAT002757	hsa-miR-	ENSG0000017741	47905619	47905642
1	6835-3p	0		

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MIMAT000479	hsa-miR-	ENSG0000017741		
7	582-3p	0	47905651	47905672
MIMAT001819	hsa-miR-	ENSG0000017741		
9	3924	0	47905672	47905694
MIMAT000288	hsa-miR-	ENSG0000017741		
2	510-5p	0	47905679	47905702
MIMAT001025	hsa-miR-	ENSG0000017741		
1	449c-5p	0	47905736	47905762
MIMAT000068	hsa-miR-	ENSG0000017741		
5	34b-5p	0	47905738	47905762
MIMAT001351	hsa-miR-	ENSG0000017741		
7	2682-5p	0	47905738	47905762
MIMAT001505	hsa-miR-	ENSG0000017741		
0	323b-3p	0	47907425	47907441
MIMAT000282	hsa-miR-	ENSG0000017741		
3	512-3p	0	47912146	47912171
MIMAT000068	hsa-miR-	ENSG0000017741		
4	302a-3p	0	47912146	47912172
MIMAT000071	hsa-miR-	ENSG0000017741		
5	302b-3p	0	47912146	47912172
MIMAT000071	hsa-miR-	ENSG0000017741		
7	302c-3p	0	47912146	47912172

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MIMAT000071	hsa-miR-	ENSG0000017741		
8	302d-3p	0	47912146	47912172
MIMAT000072	hsa-miR-	ENSG0000017741		
4	372-3p	0	47912146	47912172
MIMAT002546	hsa-miR-	ENSG0000017741		
4	6504-5p	0	47912147	47912167
MIMAT001986	hsa-miR-	ENSG0000017741		
4	3064-5p	0	47912148	47912167
MIMAT000283	hsa-miR-	ENSG0000017741		
4	520a-3p	0	47912151	47912172
MIMAT000072	hsa-miR-	ENSG0000017741		
6	373-3p	0	47912152	47912172
MIMAT000282	hsa-miR-	ENSG0000017741		
5	520e	0	47912152	47912172
MIMAT000284	hsa-miR-	ENSG0000017741		
6	520c-3p	0	47912152	47912172
MIMAT000285	hsa-miR-	ENSG0000017741		
6	520d-3p	0	47912152	47912172
MIMAT000284	hsa-miR-	ENSG0000017741		
3	520b	0	47912153	47912172
MIMAT000593	hsa-miR-	ENSG0000017741		
1	302e	0	47912157	47912172

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MIMAT002547	hsa-miR-	ENSG0000017741	47912170	47912191
5	6509-3p	0		
MIMAT000479	hsa-miR-	ENSG0000017741	47912189	47912212
9	589-5p	0		

**Supplementary Table 4** A total of 54 potential target genes of miR-7-5p were predicted using predictive datasets miRDB, DIANA, miRmap, and PicTar.

ABCG4	CCNT2	HELLS	PDE4D	SCAMP5
ACSL4	CGGBP1	HPCAL4	PFN2	SEMA4C
ANKFY1	CKAP4	IRS2	PLCB1	SERP1
ANKRD12	CNN3	KLF12	POGK	SLC4A7
ARF4	CNOT8	KLF4	POLE4	SMARCD1
ARID4A	CSMD3	KPNA1	PPARGC1A	SNCA
ATP2B2	DACH1	LEMD3	PSME3	SPATA2
ATRX	EIF4EBP2	NR4A3	RAF1	TFRC
BMPR2	ESRRG	NXT2	RB1	VDAC1
CALU	FLRT2	OGT	RNF141	ZNF395
CAPZA1	GLI3	OSBPL11	RSBN1	