Supplementary Material

Supplementary Table i. Transcriptome-wide association study results of hip osteoarthritis.

Tissue	Gene	CHR	Z_{TWAS}	P_{TWAS}*
Skeletal muscle	*ASAP3*	1	−4.9331	< 0.001
Skeletal muscle	*THAP3*	1	2.9400	0.003
Skeletal muscle	*DFFB*	1	−2.7596	0.006
Skeletal muscle	*TMEM222*	1	2.7455	0.006
Skeletal muscle	*CAMK2N1*	1	2.6033	0.009
Skeletal muscle	*CELSR2*	1	2.5499	0.011
Skeletal muscle	*LUZP1*	1	−2.4999	0.012
Skeletal muscle	*VPS13D*	1	2.4399	0.015
Skeletal muscle	*NADK*	1	−2.4168	0.016
Skeletal muscle	*FMO4*	1	2.4167	0.016
Skeletal muscle	*FNDC5*	1	2.3445	0.019
Skeletal muscle	*FBXO6*	1	2.3397	0.019
Skeletal muscle	*ITGB3BP*	1	−2.3399	0.019
Skeletal muscle	*TMEM52*	1	2.3311	0.020
Skeletal muscle	*TRIT1*	1	−2.1668	0.030
Skeletal muscle	*ST3GAL3*	1	2.1337	0.033
Skeletal muscle	*RP11-206L10.11*	1	−2.1094	0.035
Skeletal muscle	*TCEA3*	1	−2.0873	0.037
Skeletal muscle	*CCDC163P*	1	−1.9967	0.046
Skeletal muscle	*ZNF697*	1	1.9839	0.047
Skeletal muscle	*HDLBP*	2	−4.3684	< 0.001
Skeletal muscle	*CAPG*	2	−2.9795	0.003
Skeletal muscle	*RP11-477N3.1*	2	−2.7410	0.006
Skeletal muscle	*EFHD1*	2	−2.6108	0.009
Skeletal muscle	*RGPD8*	2	−2.2224	0.026
Skeletal muscle	*GYPC*	2	−2.2212	0.026
Skeletal muscle	*CIAO1*	2	−2.2174	0.027
Skeletal muscle	*GLB1L*	2	2.2147	0.027
Skeletal muscle	*AGAP1*	2	2.1872	0.029
Skeletal muscle	*FAHD2B*	2	−2.1539	0.031
Skeletal muscle	*TFPI*	2	2.1283	0.033
Skeletal muscle	*Sep2*	2	2.0228	0.043
Skeletal muscle	*RETSAT*	2	−1.9897	0.047
Skeletal muscle	*AC009404.2*	2	−1.9774	0.048
Skeletal muscle	*AC114730.7*	2	−1.9724	0.049
Skeletal muscle	*ITIH4-AS1*	3	3.8985	< 0.001
Skeletal muscle	*RP5-966M1.6*	3	3.7270	< 0.001
Skeletal muscle	*PLOD2*	3	3.5117	< 0.001
Skeletal muscle	*TMEM110*	3	3.3561	< 0.001
Skeletal muscle	*IQCB1*	3	3.1172	0.002
Skeletal muscle	*CEP70*	3	3.0546	0.002
Skeletal muscle	*FAIM*	3	−3.0166	0.003
Skeletal muscle	*SYN2*	3	−2.8021	0.005
Skeletal muscle	*GOLGB1*	3	−2.7614	0.006
Skeletal muscle	*TEX264*	3	−2.4643	0.014
Skeletal muscle	*EAF2*	3	2.1588	0.031
Skeletal muscle	*CEP63*	3	2.0331	0.042
Skeletal muscle	*RBM6*	3	−2.0054	0.045
Skeletal muscle	*TFG*	3	−1.9828	0.047
Skeletal muscle	*RP11-173M11.2*	4	2.8989	0.004
Skeletal muscle	*AC139887.4*	4	2.8017	0.005
Skeletal muscle	*FAM149A*	4	2.7392	0.006
Skeletal muscle	*CYP4V2*	4	2.7316	0.006
Skeletal muscle	*KLKB1*	4	2.5945	0.010
Skeletal muscle	*MFAP3L*	4	−2.5382	0.011
Skeletal muscle	*MMAA*	4	−2.3624	0.018
Skeletal muscle	*PCGF3*	4	2.2706	0.023
Skeletal muscle	*RP11-440L14.1*	4	2.2206	0.026
Skeletal muscle	*UFSP2*	4	−2.1873	0.029
Skeletal muscle	*REST*	4	2.1519	0.031
Skeletal muscle	*ENPEP*	4	1.9915	0.046
Skeletal muscle	*WDR70*	5	2.7156	0.007
Skeletal muscle	*MCCC2*	5	2.2021	0.028
Skeletal muscle	*RNF130*	5	2.1880	0.029
Skeletal muscle	*LHFPL2*	5	2.1300	0.033
Skeletal muscle	*RAD17*	5	−2.0775	0.038
Skeletal muscle	*RTN4IP1*	6	2.7343	0.006
Skeletal muscle	*QRSL1*	6	2.7181	0.007
Skeletal muscle	*CD164*	6	−2.6806	0.007
Skeletal muscle	*EZR*	6	2.1906	0.029
Skeletal muscle	*NUP43*	6	2.1690	0.030
Skeletal muscle	*NFYA*	6	2.1186	0.034
Skeletal muscle	*ADAT2*	6	2.0913	0.037
Skeletal muscle	*XXbac-BPG300A18.13*	6	−2.8662	0.004
Skeletal muscle	*RPS18*	6	2.4461	0.014
Skeletal muscle	*CALU*	7	−2.8791	0.004
Skeletal muscle	*UFSP1*	7	−2.7512	0.006
Skeletal muscle	*EGFR*	7	2.5252	0.012
Skeletal muscle	*OPN1SW*	7	−2.5226	0.012
Skeletal muscle	*AC005076.5*	7	2.4720	0.013
Skeletal muscle	*HNRNPCP7*	7	2.4116	0.016
Skeletal muscle	*TRIP6*	7	2.2802	0.023
Skeletal muscle	*WBSCR27*	7	−2.1382	0.033
Skeletal muscle	*POLR2J3*	7	2.0759	0.038
Skeletal muscle	*PMS2*	7	2.0696	0.039
Skeletal muscle	*STEAP2*	7	1.9632	0.050
Skeletal muscle	*GRINA*	8	3.8140	< 0.001
Skeletal muscle	*RP11-242F4.2*	8	3.3626	< 0.001
Skeletal muscle	*FDFT1*	8	−2.3866	0.017
Skeletal muscle	*CA2*	8	−2.3806	0.017
Skeletal muscle	*FAM85A*	8	2.1104	0.035
Skeletal muscle	*BRF2*	8	2.0926	0.036
Skeletal muscle	*MFHAS1*	8	2.0688	0.039
Skeletal muscle	*FXN*	9	−2.8775	0.004
Skeletal muscle	*GAPVD1*	9	2.2813	0.023
Skeletal muscle	*HRCT1*	9	2.1994	0.028
Skeletal muscle	*CACUL1*	10	−2.9373	0.003
Skeletal muscle	*NANOS1*	10	−2.7913	0.005
Skeletal muscle	*BEND7*	10	2.3363	0.020
Skeletal muscle	*WDR11*	10	−2.1868	0.029
Skeletal muscle	*RP11-344N10.5*	10	2.1633	0.031
Skeletal muscle	*WBP1L*	10	2.1545	0.031
Skeletal muscle	*CCNY*	10	2.0398	0.041
Skeletal muscle	*BMPR1A*	10	2.0093	0.045
Skeletal muscle	*ECD*	10	−1.9861	0.047
Skeletal muscle	*RNASEH2C*	11	2.8291	0.005
Skeletal muscle	*MSANTD4*	11	2.4456	0.015
Skeletal muscle	*EIF3F*	11	−2.3785	0.017
Skeletal muscle	*DLAT*	11	2.3220	0.020
Skeletal muscle	*TMEM41B*	11	−2.0799	0.038
Skeletal muscle	*RP11-819C21.1*	11	2.0392	0.041
Skeletal muscle	*RP11-554A11.9*	11	−1.9727	0.049
Skeletal muscle	*HMBS*	11	1.9710	0.049
Skeletal muscle	*RP11-386G11.5*	12	−2.6034	0.009
Skeletal muscle	*RSRC2*	12	−2.4552	0.014
Skeletal muscle	*C12orf23*	12	−2.3784	0.017
Skeletal muscle	*CAMKK2*	12	2.0214	0.043
Skeletal muscle	*IFT88*	13	−2.5541	0.011
Skeletal muscle	*ZFYVE26*	14	3.3618	< 0.001
Skeletal muscle	*ZNF839*	14	3.3142	< 0.001
Skeletal muscle	*SERPINA5*	14	−3.1039	0.002
Skeletal muscle	*CHURC1*	14	2.1855	0.029
Skeletal muscle	*ADCY4*	14	2.1562	0.031
Skeletal muscle	*GSKIP*	14	−2.1101	0.035
Skeletal muscle	*TTC9*	14	2.0493	0.040
Skeletal muscle	*PNMA1*	14	2.0456	0.041
Skeletal muscle	*C15orf38*	15	2.6623	0.008
Skeletal muscle	*SNAPC5*	15	−2.4502	0.014
Skeletal muscle	*NMB*	15	2.3630	0.018
Skeletal muscle	*CIB1*	15	2.2435	0.025
Skeletal muscle	*CTD-3110H11.1*	15	2.1967	0.028

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Supplementary Table i (Continued)

Tissue	Gene	CHR	Z_{TWAS}	P_{TWAS}*
Skeletal muscle	*LYSMD2*	15	−2.1805	0.029
Skeletal muscle	*RP11-352G18.2*	15	2.0938	0.036
Skeletal muscle	*RP11-244F12.2*	15	−2.0793	0.038
Skeletal muscle	*SMAD3*	15	−2.0758	0.038
Skeletal muscle	*HMG20A*	15	2.0283	0.043
Skeletal muscle	*GABPB1-AS1*	15	1.9800	0.048
Skeletal muscle	*FLYWCH1*	16	−2.8870	0.004
Skeletal muscle	*MC1R*	16	2.5693	0.010
Skeletal muscle	*ZNF205*	16	2.2593	0.024
Skeletal muscle	*SNRNP25*	16	2.1452	0.032
Skeletal muscle	*NPIPB4*	16	2.0680	0.039
Skeletal muscle	*CDIP1*	16	2.0351	0.042
Skeletal muscle	*CFDP1*	16	−1.9862	0.047
Skeletal muscle	*TRPV2*	17	−2.5722	0.010
Skeletal muscle	*TOP3A*	17	−2.5017	0.012
Skeletal muscle	*RP13-20L14.6*	17	−2.3325	0.020
Skeletal muscle	*AC122129.1*	17	−2.2549	0.024
Skeletal muscle	*NARF*	17	−2.2483	0.025
Skeletal muscle	*TOM1L2*	17	−2.2440	0.025
Skeletal muscle	*SAT2*	17	−2.2301	0.026
Skeletal muscle	*SHMT1*	17	2.1716	0.030
Skeletal muscle	*ATPAF2*	17	2.0824	0.037
Skeletal muscle	*RP11-74E22.5*	17	2.0657	0.039
Skeletal muscle	*RP11-166P13.3*	17	−1.9640	0.050
Skeletal muscle	*ALKBH5*	17	1.9631	0.050
Skeletal muscle	*RP11-672L10.6*	18	−2.3737	0.018
Skeletal muscle	*SLC14A1*	18	−2.2120	0.027
Skeletal muscle	*RP11-21J18.1*	18	2.0395	0.041
Skeletal muscle	*IER2*	19	2.8151	0.005
Skeletal muscle	*CTC-250I14.6*	19	2.7921	0.005
Skeletal muscle	*SLC25A23*	19	2.6166	0.009
Skeletal muscle	*SH2D3A*	19	−2.3151	0.021
Skeletal muscle	*ZNF490*	19	2.2207	0.026
Skeletal muscle	*ZNF160*	19	2.1647	0.030
Skeletal muscle	*ZNF266*	19	2.1245	0.034
Skeletal muscle	*ZNF784*	19	2.0346	0.042
Skeletal muscle	*MANBAL*	20	2.8807	0.004
Skeletal muscle	*NDUFAF5*	20	−2.3798	0.017
Skeletal muscle	*KIF16B*	20	−2.3779	0.017
Skeletal muscle	*YWHAB*	20	−2.0900	0.037
Skeletal muscle	*TMEM50B*	21	3.1831	0.002
Skeletal muscle	*CCT8*	21	2.7298	0.006
Skeletal muscle	*TRPM2*	21	2.4529	0.014
Skeletal muscle	*PCBP3*	21	−2.4102	0.016
Skeletal muscle	*PFKL*	21	−2.1078	0.035
Skeletal muscle	*GART*	21	−2.0902	0.037
Skeletal muscle	*RNF215*	22	3.4155	< 0.001
Skeletal muscle	*IGLC3*	22	−2.2453	0.025
Skeletal muscle	*TTC38*	22	2.2300	0.026
Skeletal muscle	*KIAA0930*	22	−2.1640	0.031
Skeletal muscle	*RP1-130H16.16*	22	−2.0136	0.044
Blood	*KCNAB2*	1	−3.1597	0.002
Blood	*RNF2*	1	2.5544	0.011
Blood	*LRRC7*	1	−2.5340	0.011
Blood	*ZDHHC18*	1	2.3525	0.019
Blood	*B3GALT6*	1	−2.3177	0.021
Blood	*FAM177B*	1	2.2621	0.024
Blood	*GLT25D2*	1	2.2602	0.024
Blood	*TRIT1*	1	−2.1730	0.030
Blood	*MPZ*	1	−2.1013	0.036
Blood	*FCER1A*	1	−2.0671	0.039
Blood	*TCEA3*	1	−4.5970	< 0.001
Blood	*ST3GAL3*	1	−3.8807	< 0.001
Blood	*ID3*	1	−3.2650	0.001
Blood	*PSRC1*	1	3.0680	0.002
Blood	*NPHP4*	1	2.7558	0.006
Blood	*CPT2*	1	2.6327	0.009
Blood	*TAL1*	1	−2.5792	0.010
Blood	*FAM159A*	1	2.4352	0.015
Blood	*PEAR1*	1	−2.3862	0.017
Blood	*GFI1*	1	−2.3636	0.018
Blood	*TUFT1*	1	−2.2824	0.023
Blood	*ITGB3BP*	1	−2.1889	0.029
Blood	*ZNHIT6*	1	2.0545	0.040
Blood	*RCC2*	1	2.0241	0.043
Blood	*ST6GALNAC3*	1	−1.9796	0.048
Blood	*RNPEP*	1	2.7183	0.007
Blood	*PRUNE*	1	2.5189	0.012
Blood	*PRPF38A*	1	2.2755	0.023
Blood	*RERE*	1	2.1762	0.030
Blood	*MTHFR*	1	2.4693	0.014
Blood	*LAX1*	1	2.2040	0.028
Blood	*GGCX*	2	3.0942	0.002
Blood	*RETSAT*	2	2.4900	0.013
Blood	*MTERFD2*	2	−2.4506	0.014
Blood	*SP140*	2	−2.3442	0.019
Blood	*ASB3*	2	−2.2922	0.022
Blood	*ALMS1*	2	2.2569	0.024
Blood	*GORASP2*	2	−2.2476	0.025
Blood	*CIAO1*	2	2.2167	0.027
Blood	*THUMPD2*	2	−2.1938	0.028
Blood	*OTX1*	2	−2.0132	0.044
Blood	*PNO1*	2	−3.8675	< 0.001
Blood	*AGPS*	2	2.7168	0.007
Blood	*CNNM4*	2	2.6755	0.008
Blood	*SH3YL1*	2	−2.4328	0.015
Blood	*WDR92*	2	−2.3067	0.021
Blood	*MTIF2*	2	2.1857	0.029
Blood	*ADCY3*	2	−2.0438	0.041
Blood	*VRK2*	2	2.0363	0.042
Blood	*C1D*	2	1.9921	0.046
Blood	*IWS1*	2	−1.9739	0.048
Blood	*STK25*	2	−4.0764	< 0.001
Blood	*WDR82*	3	2.4777	0.013
Blood	*SLC6A6*	3	−2.4612	0.014
Blood	*PARP14*	3	2.2175	0.027
Blood	*CEP63*	3	2.1957	0.028
Blood	*TMEM110*	3	2.1928	0.028
Blood	*SEC13*	3	2.1581	0.031
Blood	*EBLN2*	3	2.1276	0.033
Blood	*RNF13*	3	2.1002	0.036
Blood	*EAF2*	3	−2.0709	0.038
Blood	*USP4*	3	1.9669	0.049
Blood	*GNL3*	3	−3.5505	< 0.001
Blood	*SPCS1*	3	3.1492	0.002
Blood	*NT5DC2*	3	−2.9266	0.003
Blood	*MUSTN1*	3	−2.5249	0.012
Blood	*PPM1M*	3	−2.4639	0.014
Blood	*PAK2*	3	−2.4335	0.015
Blood	*ACAA1*	3	2.3661	0.018
Blood	*GTPBP8*	3	2.3044	0.021
Blood	*GLYCTK*	3	−2.1865	0.029
Blood	*CX3CR1*	3	−2.1622	0.031
Blood	*RPL39L*	3	−2.1225	0.034
Blood	*H1FX*	3	−2.1013	0.036
Blood	*CHST13*	3	2.0801	0.038
Blood	*ATP1B3*	3	2.0465	0.041
Blood	*ITIH4*	3	3.6412	< 0.001
Blood	*CSTA*	3	3.4758	< 0.001
Blood	*RBM6*	3	−2.1553	0.031
Blood	*P2RY14*	3	2.5783	0.010
Blood	*XPC*	3	2.4170	0.016
Blood	*KPNA1*	3	−2.1945	0.028
Blood	*ANAPC13*	3	2.0518	0.040
Blood	*D4S234E*	4	−3.4735	< 0.001
Blood	*MFSD8*	4	3.3630	< 0.001
Blood	*SPP1*	4	2.8772	0.004
Blood	*FAM160A1*	4	−2.7406	0.006

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Supplementary Table i (Continued)

Tissue	Gene	CHR	Z_{TWAS}	P_{TWAS}*
Blood	*ARAP2*	4	−2.6015	0.009
Blood	*LRP2BP*	4	−2.3585	0.018
Blood	*ZNF595*	4	−2.1900	0.029
Blood	*SNX25*	4	−2.1525	0.031
Blood	*IL8*	4	2.0856	0.037
Blood	*SCRG1*	4	2.0638	0.039
Blood	*ANXA5*	4	2.0502	0.040
Blood	*TIFA*	4	−2.0092	0.045
Blood	*DCAF16*	4	−2.5180	0.012
Blood	*NR3C2*	4	2.4690	0.014
Blood	*ANKRD17*	4	2.2709	0.023
Blood	*POLR2B*	4	−2.2070	0.027
Blood	*Sep11*	4	2.1689	0.030
Blood	*H2AFZ*	4	−2.3872	0.017
Blood	*ARHGAP24*	4	2.2591	0.024
Blood	*HINT1*	5	−2.2854	0.022
Blood	*HMGXB3*	5	−2.2370	0.025
Blood	*C5orf35*	5	2.1833	0.029
Blood	*CCDC125*	5	2.0888	0.037
Blood	*C5orf32*	5	1.9635	0.050
Blood	*LHFPL2*	5	3.0455	0.002
Blood	*SLC25A46*	5	2.4059	0.016
Blood	*BRD9*	5	−2.2032	0.028
Blood	*CDK7*	5	2.1885	0.029
Blood	*CSF1R*	5	2.1863	0.029
Blood	*PAM*	5	2.1403	0.032
Blood	*PCYOX1L*	5	−2.1317	0.033
Blood	*RHOBTB3*	5	2.0722	0.038
Blood	*CNOT6*	5	−2.0370	0.042
Blood	*ETV7*	6	−2.1758	0.030
Blood	*EPB41L2*	6	2.0769	0.038
Blood	*CRISP3*	6	2.0610	0.039
Blood	*SERPINB6*	6	2.0142	0.044
Blood	*BAT1*	6	−2.3805	0.017
Blood	*C6orf48*	6	−2.1767	0.030
Blood	*BTN2A1*	6	2.0536	0.040
Blood	*SHPRH*	6	−3.0392	0.002
Blood	*QRSL1*	6	2.8229	0.005
Blood	*ZNF318*	6	2.7283	0.006
Blood	*RTN4IP1*	6	−2.6817	0.007
Blood	*SAMD3*	6	−2.3553	0.019
Blood	*NFYA*	6	2.2169	0.027
Blood	*FOXC1*	6	−2.1842	0.029
Blood	*PDSS2*	6	−2.1459	0.032
Blood	*FAM65B*	6	2.1135	0.035
Blood	*MDGA1*	6	2.1037	0.035
Blood	*CCND3*	6	2.0795	0.038
Blood	*NT5DC1*	6	2.0793	0.038
Blood	*SERPINB1*	6	2.0500	0.040
Blood	*CD164*	6	2.0178	0.044
Blood	*SUPT3H*	6	1.9969	0.046
Blood	*RPS18*	6	2.8015	0.005
Blood	*STK19*	6	−2.2751	0.023
Blood	*TAGAP*	6	−2.1810	0.029
Blood	*FBXL13*	7	−2.5698	0.010
Blood	*NCAPG2*	7	2.4994	0.012
Blood	*ESYT2*	7	−2.2125	0.027
Blood	*EPHB4*	7	−2.0962	0.036
Blood	*VPS41*	7	−2.0608	0.039
Blood	*TES*	7	−3.1583	0.002
Blood	*UBE2H*	7	2.6873	0.007
Blood	*CAV2*	7	−2.4771	0.013
Blood	*GIMAP1*	7	2.2568	0.024
Blood	*CCDC126*	7	2.2281	0.026
Blood	*WBSCR27*	7	−2.1705	0.030
Blood	*GIMAP5*	7	−2.1447	0.032
Blood	*EPDR1*	7	2.0605	0.039
Blood	*SLC4A2*	7	−2.0552	0.040
Blood	*GIGYF1*	7	1.9922	0.046
Blood	*UFSP1*	7	−2.7192	0.007
Blood	*LMBR1*	7	2.3351	0.020
Blood	*PTDSS1*	8	3.5879	< 0.001
Blood	*CA2*	8	3.5526	< 0.001
Blood	*ASPH*	8	2.7210	0.007
Blood	*TRIM35*	8	2.4395	0.015
Blood	*PPP1R3B*	8	2.3290	0.020
Blood	*ZDHHC2*	8	−2.2894	0.022
Blood	*HEY1*	8	−2.2761	0.023
Blood	*MYST3*	8	2.2207	0.026
Blood	*LACTB2*	8	2.2192	0.027
Blood	*MFHAS1*	8	2.1014	0.036
Blood	*ERI1*	8	2.0621	0.039
Blood	*ZHX2*	8	−2.0461	0.041
Blood	*KIAA1967*	8	−2.9669	0.003
Blood	*PARP10*	8	−2.7671	0.006
Blood	*ANKRD46*	8	−2.6562	0.008
Blood	*MTMR9*	8	−2.4421	0.015
Blood	*CCDC25*	8	2.3575	0.018
Blood	*IMPAD1*	8	2.1872	0.029
Blood	*UBXN2B*	8	2.1752	0.030
Blood	*ARHGEF10*	8	1.9895	0.047
Blood	*GRINA*	8	−3.6641	< 0.001
Blood	*FXN*	9	−2.2718	0.023
Blood	*KANK1*	9	2.2007	0.028
Blood	*PLAA*	9	2.0687	0.039
Blood	*SEMA4D*	9	1.9897	0.047
Blood	*URM1*	9	−2.8365	0.005
Blood	*PTGDS*	9	2.7880	0.005
Blood	*SLC25A25*	9	2.5429	0.011
Blood	*RXRA*	9	2.5350	0.011
Blood	*GAS1*	9	−2.2424	0.025
Blood	*GALNT12*	9	−2.2420	0.025
Blood	*GFI1B*	9	−2.1053	0.035
Blood	*NDUFA8*	9	−1.9888	0.047
Blood	*SURF6*	9	2.3669	0.018
Blood	*C10orf11*	10	−2.4967	0.013
Blood	*ASB13*	10	−2.2162	0.027
Blood	*ECD*	10	−2.1197	0.034
Blood	*FAM107B*	10	−2.1113	0.035
Blood	*SEC31B*	10	−2.0468	0.041
Blood	*PTPLA*	10	−2.7996	0.005
Blood	*PRDX3*	10	−2.7567	0.006
Blood	*MRPS16*	10	2.4677	0.014
Blood	*SUPV3L1*	10	2.3758	0.018
Blood	*FUT11*	10	2.3146	0.021
Blood	*BTRC*	10	−2.2805	0.023
Blood	*CHST15*	10	2.2478	0.025
Blood	*WDFY4*	10	−2.1850	0.029
Blood	*ENTPD1*	10	−2.1705	0.030
Blood	*NUDT13*	10	−2.0560	0.040
Blood	*TM9SF3*	10	2.0169	0.044
Blood	*TPH1*	11	−2.6675	0.008
Blood	*PAFAH1B2*	11	2.2419	0.025
Blood	*BSCL2*	11	2.1337	0.033
Blood	*TRAPPC4*	11	2.1204	0.034
Blood	*CASP1*	11	2.0673	0.039
Blood	*CCS*	11	−2.0532	0.040
Blood	*TMEM133*	11	3.1359	0.002
Blood	*SERPINH1*	11	3.0282	0.003
Blood	*CCDC15*	11	3.0050	0.003
Blood	*AP2A2*	11	2.9967	0.003
Blood	*CATSPER1*	11	2.9281	0.003
Blood	*CRYAB*	11	2.9084	0.004
Blood	*MAP3K11*	11	2.8164	0.005
Blood	*LPXN*	11	−2.5434	0.011
Blood	*IGSF9B*	11	2.4351	0.015
Blood	*ST3GAL4*	11	−2.4064	0.016
Blood	*EIF3M*	11	−2.2587	0.024

(Continued)

Supplementary Table i (Continued)

Tissue	Gene	CHR	Z_{TWAS}	P_{TWAS}*
Blood	*BRMS1*	11	−2.2551	0.024
Blood	*ARCN1*	11	−2.1993	0.028
Blood	*MS4A6A*	11	−2.1934	0.028
Blood	*ALG8*	11	−2.1826	0.029
Blood	*TMEM80*	11	−2.1214	0.034
Blood	*SLC35C1*	11	2.1081	0.035
Blood	*FAM89B*	11	−1.9910	0.047
Blood	*IFITM3*	11	3.2155	0.001
Blood	*COPB1*	11	2.7936	0.005
Blood	*ADM*	11	−2.6631	0.008
Blood	*NACA*	12	2.7941	0.005
Blood	*AMIGO2*	12	−2.7561	0.006
Blood	*NACA2*	12	2.7552	0.006
Blood	*TMEM106C*	12	2.3490	0.019
Blood	*PRIM1*	12	−2.3363	0.020
Blood	*EPS8*	12	2.1884	0.029
Blood	*RAB3IP*	12	−2.0175	0.044
Blood	*BAZ2A*	12	−3.3276	< 0.001
Blood	*PTMS*	12	−2.7256	0.006
Blood	*MARS*	12	2.6875	0.007
Blood	*TDG*	12	2.6456	0.008
Blood	*C1RL*	12	−2.6352	0.008
Blood	*RAB21*	12	2.6304	0.009
Blood	*GLT1D1*	12	−2.3850	0.017
Blood	*MAP1LC3B2*	12	−2.2698	0.023
Blood	*SPSB2*	12	−2.2644	0.024
Blood	*METAP2*	12	−2.1976	0.028
Blood	*MANSC1*	12	2.1060	0.035
Blood	*LRRC23*	12	−2.1024	0.036
Blood	*ITGB7*	12	2.0293	0.042
Blood	*LAG3*	12	2.0229	0.043
Blood	*TCP11L2*	12	−1.9741	0.048
Blood	*MRPL42*	12	−3.0737	0.002
Blood	*IFT88*	13	−2.8060	0.005
Blood	*ALOX5AP*	13	2.1890	0.029
Blood	*ITM2B*	13	2.1720	0.030
Blood	*SETDB2*	13	2.5306	0.011
Blood	*GNG2*	14	3.0245	0.003
Blood	*RNASE3*	14	−2.8441	0.005
Blood	*RABGGTA*	14	−2.7871	0.005
Blood	*RNASE2*	14	−2.6411	0.008
Blood	*C14orf118*	14	−2.6379	0.008
Blood	*DCAF4*	14	2.3973	0.017
Blood	*CFL2*	14	2.2975	0.022
Blood	*PSEN1*	14	−2.0943	0.036
Blood	*METTL3*	14	−2.8025	0.005
Blood	*ADCY4*	14	2.6570	0.008
Blood	*ANKRD9*	14	2.5564	0.011
Blood	*RBM23*	14	−2.3159	0.021
Blood	*FBXO34*	14	−2.2864	0.022
Blood	*RAB15*	14	−2.2003	0.028
Blood	*LGALS3*	14	2.1271	0.033
Blood	*TOX4*	14	−2.1109	0.035
Blood	*AKT1*	14	−2.1001	0.036
Blood	*PCK2*	14	2.0333	0.042
Blood	*PNN*	14	−2.0013	0.045
Blood	*LTB4R*	14	−2.0012	0.045
Blood	*CHURC1*	14	−2.2011	0.028
Blood	*USP3*	15	−2.0345	0.042
Blood	*USP8*	15	−2.8043	0.005
Blood	*LACTB*	15	2.4123	0.016
Blood	*TMOD2*	15	2.5235	0.012
Blood	*CIB1*	15	2.3798	0.017
Blood	*KIAA0174*	16	3.1488	0.002
Blood	*CYBA*	16	−2.8708	0.004
Blood	*RNF166*	16	−2.6673	0.008
Blood	*C16orf13*	16	−2.6434	0.008
Blood	*TNRC6A*	16	−2.3207	0.020
Blood	*GALNS*	16	2.1849	0.029
Blood	*MON1B*	16	2.0576	0.040
Blood	*SNAI3*	16	−3.1753	0.002
Blood	*USP10*	16	−2.8674	0.004
Blood	*FLYWCH1*	16	−2.7657	0.006
Blood	*NUP93*	16	2.6178	0.009
Blood	*MAPK3*	16	−2.4102	0.016
Blood	*ST3GAL2*	16	2.3777	0.017
Blood	*CIITA*	16	2.3454	0.019
Blood	*AKTIP*	16	−2.2213	0.026
Blood	*ARL6IP1*	16	2.1433	0.032
Blood	*IQCK*	16	−2.1159	0.034
Blood	*FLYWCH2*	16	−2.0150	0.044
Blood	*CES1*	16	2.0022	0.045
Blood	*KLHL36*	16	1.9933	0.046
Blood	*MLST8*	16	1.9791	0.048
Blood	*MEFV*	16	2.6820	0.007
Blood	*PMM2*	16	−3.7253	< 0.001
Blood	*MTHFSD*	16	−2.3878	0.017
Blood	*SLC7A6*	16	−2.3226	0.020
Blood	*NPEPPS*	17	−2.5545	0.011
Blood	*SENP3*	17	−2.4676	0.014
Blood	*MRPL10*	17	2.4300	0.015
Blood	*SLFN12L*	17	1.9789	0.048
Blood	*FADS6*	17	1.9790	0.048
Blood	*ELAC2*	17	2.9874	0.003
Blood	*RSAD1*	17	−2.6247	0.009
Blood	*MPP2*	17	−2.5797	0.010
Blood	*G6PC3*	17	2.5319	0.011
Blood	*SGCA*	17	−2.3231	0.020
Blood	*CD300LB*	17	2.3093	0.021
Blood	*SHMT1*	17	2.2887	0.022
Blood	*TOB1*	17	−2.2126	0.027
Blood	*MKS1*	17	2.1765	0.030
Blood	*ATPAF2*	17	2.1372	0.033
Blood	*HEXDC*	17	2.1349	0.033
Blood	*SREBF1*	17	−2.1331	0.033
Blood	*XYLT2*	17	2.1181	0.034
Blood	*GNGT2*	17	2.0975	0.036
Blood	*HEXIM2*	17	2.0839	0.037
Blood	*RUNDC3A*	17	−2.0781	0.038
Blood	*ST6GALNAC1*	17	−2.0737	0.038
Blood	*SLC47A1*	17	−2.0695	0.039
Blood	*CDK5RAP3*	17	2.0624	0.039
Blood	*ACAP1*	17	−1.9676	0.049
Blood	*SPATA20*	17	−2.5391	0.011
Blood	*COPS3*	17	−2.3813	0.017
Blood	*JUP*	17	2.4785	0.013
Blood	*SAT2*	17	−2.2868	0.022
Blood	*SLC14A1*	18	−2.4334	0.015
Blood	*EPB41L3*	18	−2.0369	0.042
Blood	*PSTPIP2*	18	2.9937	0.003
Blood	*ALPK2*	18	2.1031	0.036
Blood	*MYL12A*	18	2.1031	0.036
Blood	*RAB31*	18	−2.4705	0.014
Blood	*RNMT*	18	2.0347	
Blood	*DDA1*	19	−2.7776	0.006
Blood	*ZNF333*	19	−2.6936	0.007
Blood	*ZNF160*	19	2.3018	0.021
Blood	*LSM14A*	19	−2.1545	0.031
Blood	*ELOF1*	19	−2.1142	0.035
Blood	*ZNF497*	19	−2.0037	0.045
Blood	*ZNF257*	19	1.9989	0.046
Blood	*U2AF1L4*	19	1.9890	0.047
Blood	*FBL*	19	−2.9431	0.003
Blood	*ZSCAN18*	19	−2.9115	0.004
Blood	*RNF126*	19	2.4823	0.013
Blood	*PGLS*	19	2.1914	0.028
Blood	*ZNF329*	19	−2.1845	0.029
Blood	*EMR2*	19	−2.1120	0.035

(Continued)

Supplementary Table i (Continued)

Tissue	Gene	CHR	Z_{TWAS}	P_{TWAS}*
Blood	*ECH1*	19	–2.1010	0.036
Blood	*ZFP30*	19	2.0490	0.041
Blood	*ZNF121*	19	2.9706	0.003
Blood	*DNAJB1*	19	2.5866	0.010
Blood	*PVRL2*	19	2.2917	0.022
Blood	*C20orf108*	20	–3.2698	0.001
Blood	*RNF114*	20	–2.8301	0.005
Blood	*YWHAB*	20	–2.3146	0.021
Blood	*SIRPB2*	20	2.0543	0.040
Blood	*LOC284751*	20	1.9667	0.049
Blood	*CST3*	20	–2.1425	0.032
Blood	*RIN2*	20	2.0503	0.040
Blood	*EIF6*	20	–2.6533	0.008
Blood	*NCRNA00189*	21	–2.5893	0.010
Blood	*C21orf7*	21	2.3566	0.018
Blood	*C21orf62*	21	2.2019	0.028
Blood	*TMEM50B*	21	3.0698	0.002
Blood	*IFNGR2*	21	–2.8391	0.005
Blood	*TTC3*	21	–2.2765	0.023
Blood	*CCT8*	21	–2.2516	0.024
Blood	*TRPM2*	21	2.1630	0.031
Blood	*RWDD2B*	21	–3.1905	0.001
Blood	*N6AMT1*	21	–2.3940	0.017
Blood	*APOBEC3B*	22	–2.7419	0.006
Blood	*CDC42EP1*	22	–2.2122	0.027
Blood	*BAIAP2L2*	22	2.5529	0.011
Blood	*SNRPD3*	22	–2.8314	0.005

*Each PTWAS value was calculated by transcriptome-wide association study analysis.
CHR, chromosome; TWAS, transcriptome-wide association study.

Supplementary Table ii. Transcriptome-wide association study results of knee osteoarthritis.

Tissue	Gene	CHR	Z_{TWAS}	P_{TWAS}*
Skeletal muscle	*SLC35E2*	1	3.0671	0.002
Skeletal muscle	*DEGS1*	1	3.0198	0.003
Skeletal muscle	*RP11-345P4.10*	1	2.8461	0.004
Skeletal muscle	*NADK*	1	–2.5771	0.010
Skeletal muscle	*FBXO6*	1	2.5250	0.012
Skeletal muscle	*RP11-767N6.7*	1	2.4404	0.015
Skeletal muscle	*SLC35E2B*	1	2.4357	0.015
Skeletal muscle	*ABL2*	1	2.3661	0.018
Skeletal muscle	*RP1-283E3.4*	1	–2.3232	0.020
Skeletal muscle	*GPBP1L1*	1	2.2399	0.025
Skeletal muscle	*TMEM52*	1	2.1333	0.033
Skeletal muscle	*FAAH*	1	2.1261	0.034
Skeletal muscle	*PRKAB2*	1	–2.1239	0.034
Skeletal muscle	*FCGR2C*	1	–2.0845	0.037
Skeletal muscle	*PRMT6*	1	–2.0593	0.040
Skeletal muscle	*DRAM2*	1	2.0133	0.044
Skeletal muscle	*FNDC5*	1	–1.9766	0.048
Skeletal muscle	*AGAP1*	2	3.1369	0.002
Skeletal muscle	*TPRKB*	2	–2.8738	0.004
Skeletal muscle	*TTC27*	2	2.3836	0.017
Skeletal muscle	*MCEE*	2	–2.3423	0.019
Skeletal muscle	*GPR17*	2	2.2568	0.024
Skeletal muscle	*SPTBN1*	2	–2.1945	0.028
Skeletal muscle	*HMGB1P31*	2	–2.1670	0.030
Skeletal muscle	*AC016747.3*	2	2.1554	0.031
Skeletal muscle	*TFPI*	2	2.1443	0.032
Skeletal muscle	*ALMS1*	2	2.0883	0.037
Skeletal muscle	*AC125232.1*	2	2.0867	0.037
Skeletal muscle	*RTN4*	2	2.0285	0.043
Skeletal muscle	*AC092159.2*	2	2.0093	0.045
Skeletal muscle	*GCC2*	2	1.9924	0.046
Skeletal muscle	*PAX8*	2	1.9727	0.049
Skeletal muscle	*MKRN2*	3	–2.6262	0.009
Skeletal muscle	*ZNF502*	3	–2.5279	0.012
Skeletal muscle	*HYAL3*	3	–2.4894	0.013
Skeletal muscle	*GOLGB1*	3	–2.2231	0.026
Skeletal muscle	*SLC51A*	3	–2.2084	0.027
Skeletal muscle	*RBM6*	3	–2.1675	0.030
Skeletal muscle	*MLF1*	3	2.1549	0.031
Skeletal muscle	*PPP1R2*	3	2.0677	0.039
Skeletal muscle	*RPL29*	3	2.0447	0.041
Skeletal muscle	*APPL1*	3	–2.0379	0.042
Skeletal muscle	*GTF2E1*	3	2.0266	0.043
Skeletal muscle	*PLOD2*	3	2.0079	0.045
Skeletal muscle	*RP11-731C17.2*	3	1.9821	0.048
Skeletal muscle	*CYP4V2*	4	2.6905	0.007
Skeletal muscle	*KLKB1*	4	2.6301	0.009
Skeletal muscle	*UBE2D3*	4	2.5646	0.010
Skeletal muscle	*ZFYVE28*	4	–2.2557	0.024
Skeletal muscle	*FAM53A*	4	–2.1731	0.030
Skeletal muscle	*RPL9*	4	2.1167	0.034
Skeletal muscle	*FBXL17*	5	–2.7204	0.007
Skeletal muscle	*OXCT1*	5	2.6704	0.008
Skeletal muscle	*OXCT1-AS1*	5	2.4911	0.013
Skeletal muscle	*TBC1D9B*	5	–2.3742	0.018
Skeletal muscle	*TBCA*	5	2.3446	0.019
Skeletal muscle	*PPWD1*	5	2.2868	0.022
Skeletal muscle	*TRAPPC13*	5	2.1950	0.028
Skeletal muscle	*SETD9*	5	2.1776	0.029
Skeletal muscle	*AC034220.3*	5	–2.1586	0.031
Skeletal muscle	*GUSBP3*	5	2.1444	0.032
Skeletal muscle	*RRAGD*	6	–3.2057	0.001
Skeletal muscle	*LYRM4*	6	2.1645	0.030
Skeletal muscle	*EZR*	6	2.0852	0.037
Skeletal muscle	*KLHDC3*	6	–2.0682	0.039
Skeletal muscle	*GNMT*	6	–1.9924	0.046
Skeletal muscle	*PEX6*	6	1.9632	0.050
Skeletal muscle	*BTN3A2*	6	–2.9663	0.003
Skeletal muscle	*RP5-874C20.3*	6	–2.7775	0.006
Skeletal muscle	*HLA-K*	6	–2.5985	0.009
Skeletal muscle	*HIST1H2BD*	6	2.2687	0.023
Skeletal muscle	*HCG27*	6	–2.1312	0.033
Skeletal muscle	*MICB*	6	2.0595	0.040
Skeletal muscle	*HLA-DRB1*	6	–2.0519	0.040
Skeletal muscle	*ZNF192P1*	6	1.9776	0.048
Skeletal muscle	*PMS2P5*	7	–2.8700	0.004
Skeletal muscle	*POM121B*	7	2.3730	0.018
Skeletal muscle	*CHN2*	7	–1.9989	0.046
Skeletal muscle	*EMC2*	8	–3.1374	0.002
Skeletal muscle	*GPIHBP1*	8	–2.8119	0.005
Skeletal muscle	*RP11-981G7.6*	8	2.0099	0.044
Skeletal muscle	*TONSL*	8	–2.0099	0.045
Skeletal muscle	*LY6K*	8	1.9927	0.046
Skeletal muscle	*SMIM19*	8	–1.9839	0.047
Skeletal muscle	*TMEM8B*	9	–3.2258	0.001
Skeletal muscle	*LINC00476*	9	2.8918	0.004
Skeletal muscle	*RP11-112J3.16*	9	–2.6080	0.009
Skeletal muscle	*NUDT2*	9	2.4493	0.014
Skeletal muscle	*MPDZ*	9	2.2620	0.024
Skeletal muscle	*RP11-522I20.3*	9	2.1359	0.033
Skeletal muscle	*CAAP1*	9	2.0626	0.039
Skeletal muscle	*TMEM245*	9	–2.0231	0.043
Skeletal muscle	*ZNF33B*	10	2.8998	0.004
Skeletal muscle	*WBP1L*	10	2.4898	0.013

(Continued)

Supplementary Table ii (Continued)

Tissue	Gene	CHR	Z_{TWAS}	P_{TWAS}*
Skeletal muscle	*BMPR1A*	10	2.2952	0.022
Skeletal muscle	*ZNF33B*	10	2.2434	0.025
Skeletal muscle	*FAM149B1*	10	–2.1912	0.028
Skeletal muscle	*ANKRD26*	10	–2.0623	0.039
Skeletal muscle	*CD59*	11	2.7136	0.007
Skeletal muscle	*GLB1L2*	11	2.5092	0.012
Skeletal muscle	*CCDC82*	11	–2.2570	0.024
Skeletal muscle	*RAD9A*	11	–2.1534	0.031
Skeletal muscle	*SETD8*	12	–2.5303	0.011
Skeletal muscle	*PPM1H*	12	–2.4998	0.012
Skeletal muscle	*SLC15A4*	12	–2.3871	0.017
Skeletal muscle	*LIMA1*	12	–2.2341	0.026
Skeletal muscle	*AMDHD1*	12	2.1333	0.033
Skeletal muscle	*RP11-967K21.1*	12	2.1130	0.035
Skeletal muscle	*GOLGA2B*	12	–2.0943	0.036
Skeletal muscle	*ADAM1A*	12	–2.0689	0.039
Skeletal muscle	*DDX55*	12	2.0556	0.040
Skeletal muscle	*MRPL42*	12	–2.0058	0.045
Skeletal muscle	*PDE3A*	12	–1.9772	0.048
Skeletal muscle	*CKAP2*	13	3.3060	< 0.001
Skeletal muscle	*MED4*	13	–3.1481	0.002
Skeletal muscle	*MED4-AS1*	13	–2.7086	0.007
Skeletal muscle	*SUCLA2*	13	2.3775	0.017
Skeletal muscle	*C1QTNF9B-AS1*	13	2.2570	0.024
Skeletal muscle	*ALG11*	13	2.2103	0.027
Skeletal muscle	*WBP4*	13	–2.0738	0.038
Skeletal muscle	*NEK3*	13	–2.0260	0.043
Skeletal muscle	*SERPINA5*	14	–3.0842	0.002
Skeletal muscle	*C14orf39*	14	–2.1197	0.034
Skeletal muscle	*COX16*	14	–1.9886	0.047
Skeletal muscle	*TRPM7*	15	–2.4773	0.013
Skeletal muscle	*DMXL2*	15	–2.4700	0.014
Skeletal muscle	*RPS17*	15	–2.2458	0.025
Skeletal muscle	*SPG21*	15	–2.2420	0.025
Skeletal muscle	*MAN2C1*	15	–2.0280	0.043
Skeletal muscle	*DET1*	15	–1.9956	0.046
Skeletal muscle	*RP11-347C12.1*	16	3.8161	< 0.001
Skeletal muscle	*AC009133.12*	16	2.8580	0.004
Skeletal muscle	*TBX6*	16	2.7870	0.005
Skeletal muscle	*RPL13*	16	–2.6734	0.008
Skeletal muscle	*RP11-46C24.7*	16	–2.4835	0.013
Skeletal muscle	*MC1R*	16	2.4495	0.014
Skeletal muscle	*MT1F*	16	–2.3363	0.020
Skeletal muscle	*RBL2*	16	2.3104	0.021
Skeletal muscle	*NPIPA2*	16	–2.1817	0.029
Skeletal muscle	*RP5-1142A6.5*	16	–2.1660	0.030
Skeletal muscle	*GOT2*	16	–2.1150	0.034
Skeletal muscle	*RP11-196G11.2*	16	–2.1063	0.035
Skeletal muscle	*RAB40B*	17	–3.0924	0.002
Skeletal muscle	*ASB16*	17	3.0667	0.002
Skeletal muscle	*HDAC5*	17	2.7871	0.005
Skeletal muscle	*TRIM37*	17	2.5914	0.010
Skeletal muscle	*SAT2*	17	–2.3615	0.018
Skeletal muscle	*LIG3*	17	–2.3197	0.020
Skeletal muscle	*HEATR6*	17	2.1606	0.031
Skeletal muscle	*SCRN2*	17	2.1386	0.033
Skeletal muscle	*RP5-837J1.2*	17	–2.1255	0.034
Skeletal muscle	*ATPAF2*	17	2.0539	0.040
Skeletal muscle	*TOP3A*	17	–1.9909	0.047
Skeletal muscle	*RP11-49K24.8*	18	2.0222	0.043
Skeletal muscle	*ZNF419*	19	2.5334	0.011
Skeletal muscle	*PNMAL1*	19	–2.2270	0.026
Skeletal muscle	*ZNF577*	19	–2.1532	0.031
Skeletal muscle	*CTB-50L17.9*	19	–2.1346	0.033
Skeletal muscle	*KRI1*	19	2.0978	0.036
Skeletal muscle	*ZNF567*	19	2.0747	0.038
Skeletal muscle	*SH2D3A*	19	–1.9703	0.049
Skeletal muscle	*CEP250*	20	3.4440	< 0.001
Skeletal muscle	*UQCC1*	20	3.3196	< 0.001
Skeletal muscle	*PCMTD2*	20	3.3019	0.001
Skeletal muscle	*RGS19*	20	3.1641	0.002
Skeletal muscle	*YWHAB*	20	–2.8597	0.004
Skeletal muscle	*FRG1B*	20	–2.1542	0.031
Skeletal muscle	*ATP9A*	20	–2.0847	0.037
Skeletal muscle	*MANBAL*	20	2.0795	0.038
Skeletal muscle	*CCT8*	21	2.7605	0.006
Skeletal muscle	*IFNGR2*	21	2.4599	0.014
Skeletal muscle	*TMEM50B*	21	2.2934	0.022
Skeletal muscle	*N6AMT1*	21	2.2178	0.027
Skeletal muscle	*PSMG1*	21	2.1677	0.030
Skeletal muscle	*PTTG1IP*	21	2.0885	0.037
Skeletal muscle	*RRP7A*	22	–2.8707	0.004
Skeletal muscle	*LINC00899*	22	–2.5107	0.012
Skeletal muscle	*AC006547.15*	22	2.0427	0.041
Skeletal muscle	*AP000351.10*	22	1.9899	0.047
Skeletal muscle	*SRRD*	22	–1.9831	0.047
Blood	*PADI2*	1	–2.2655	0.024
Blood	*SMG5*	1	–2.1014	0.036
Blood	*MRPS21*	1	2.7895	0.005
Blood	*MPZ*	1	–2.7788	0.006
Blood	*PIK3R3*	1	2.6943	0.007
Blood	*B3GALT6*	1	–2.5839	0.010
Blood	*JUN*	1	2.4649	0.014
Blood	*PGM1*	1	–2.4542	0.014
Blood	*FAM177B*	1	2.3332	0.020
Blood	*C1orf85*	1	–2.1609	0.031
Blood	*KIAA0754*	1	2.0966	0.036
Blood	*KIAA1324*	1	–2.0850	0.037
Blood	*PAQR6*	1	–2.0346	0.042
Blood	*SF3A3*	1	–2.0314	0.042
Blood	*PDZK1IP1*	1	–2.0270	0.043
Blood	*MIER1*	1	–1.9836	0.047
Blood	*KIF1B*	1	–1.9707	0.049
Blood	*DOCK7*	1	–2.8426	0.005
Blood	*SELP*	1	2.7301	0.006
Blood	*CAPZB*	1	2.6959	0.007
Blood	*USF1*	1	2.6615	0.008
Blood	*TMEM69*	1	2.6436	0.008
Blood	*FBXO6*	1	2.5690	0.010
Blood	*BATF3*	1	2.5309	0.011
Blood	*EBNA1BP2*	1	–2.5209	0.012
Blood	*CCDC17*	1	2.4367	0.015
Blood	*CASP9*	1	2.4185	0.016
Blood	*BCL10*	1	2.3997	0.016
Blood	*CAMK2N1*	1	–2.3751	0.018
Blood	*SH3GLB1*	1	–2.3742	0.018
Blood	*PRMT6*	1	–2.3314	0.020
Blood	*RUNX3*	1	2.3285	0.020
Blood	*FAAH*	1	2.3185	0.020
Blood	*AK2*	1	2.2349	0.025
Blood	*POMGNT1*	1	–2.2120	0.027
Blood	*IPP*	1	2.2004	0.028
Blood	*LYST*	1	–2.1924	0.028
Blood	*HS2ST1*	1	–2.1889	0.029
Blood	*RABGAP1L*	1	–2.1461	0.032
Blood	*SCYL3*	1	2.1170	0.034
Blood	*MRPL20*	1	2.0839	0.037
Blood	*KLHL12*	1	–2.0440	0.041
Blood	*MRPL37*	1	–1.9886	0.047
Blood	*GPD2*	2	–3.2341	0.001
Blood	*ALMS1*	2	2.8558	0.004
Blood	*CRIPT*	2	–2.0808	0.038
Blood	*NEB*	2	2.6772	0.007
Blood	*FASTKD1*	2	2.6338	0.008
Blood	*DDX18*	2	2.4436	0.015
Blood	*GCC2*	2	1.9817	0.048
Blood	*DOCK10*	2	–2.7458	0.006
Blood	*DARS*	2	–2.7379	0.006

(Continued)

Supplementary Table ii (Continued)

Tissue	Gene	CHR	Z_{TWAS}	P_{TWAS}*
Blood	*RBMS1*	2	2.7226	0.007
Blood	*FKBP1B*	2	–2.7215	0.007
Blood	*CDC42EP3*	2	–2.7172	0.007
Blood	*LANCL1*	2	–2.6669	0.008
Blood	*PDCL3*	2	2.6075	0.009
Blood	*STRADB*	2	–2.5413	0.011
Blood	*COMMD1*	2	2.4340	0.015
Blood	*PUS10*	2	2.3888	0.017
Blood	*PCYOX1*	2	2.3840	0.017
Blood	*WDSUB1*	2	2.3644	0.018
Blood	*CENPO*	2	2.3556	0.019
Blood	*GCA*	2	–2.3468	0.019
Blood	*SFXN5*	2	2.2719	0.023
Blood	*NRBP1*	2	–2.2598	0.024
Blood	*WIPF1*	2	–2.1958	0.028
Blood	*REL*	2	2.1818	0.029
Blood	*EPAS1*	2	2.1455	0.032
Blood	*BCS1L*	2	–2.1285	0.033
Blood	*RAB11FIP5*	2	–2.0608	0.039
Blood	*WDR75*	2	–2.0541	0.040
Blood	*HK2*	2	–2.0394	0.041
Blood	*SNX17*	2	–2.0332	0.042
Blood	*PSD4*	2	–2.0215	0.043
Blood	*ZNF502*	3	–2.5511	0.011
Blood	*DIRC2*	3	–2.4763	0.013
Blood	*ACPL2*	3	–2.3512	0.019
Blood	*HSPBAP1*	3	–2.2156	0.027
Blood	*RBM6*	3	–2.3570	0.018
Blood	*KCNAB1*	3	–2.3043	0.021
Blood	*CSTA*	3	2.2244	0.026
Blood	*ZNF167*	3	–2.2200	0.026
Blood	*THUMPD3*	3	–2.0944	0.036
Blood	*RPL35A*	3	–2.0682	0.039
Blood	*BHLHE40*	3	–2.0027	0.045
Blood	*NCK1*	3	2.6138	0.009
Blood	*MKRN2*	3	–2.5429	0.011
Blood	*MCCC1*	3	2.4899	0.013
Blood	*EIF4E3*	3	2.4735	0.013
Blood	*PCYT1A*	3	–2.4461	0.014
Blood	*COX17*	3	2.4233	0.015
Blood	*MGLL*	3	2.3827	0.017
Blood	*LRCH3*	3	–2.3720	0.018
Blood	*TMEM43*	3	–2.3319	0.020
Blood	*NAT6*	3	2.2351	0.025
Blood	*CD96*	3	–2.1649	0.030
Blood	*KPNA1*	3	–2.1318	0.033
Blood	*HYAL3*	3	–2.1210	0.034
Blood	*CCDC66*	3	–2.1052	0.035
Blood	*SELK*	3	–2.0565	0.040
Blood	*TFRC*	3	–2.0487	0.041
Blood	*ZNF35*	3	–2.0213	0.043
Blood	*ACAA1*	3	1.9975	0.046
Blood	*FSTL1*	3	1.9775	0.048
Blood	*NFXL1*	4	2.0678	0.039
Blood	*MMAA*	4	–2.8780	0.004
Blood	*PPARGC1A*	4	–2.4332	0.015
Blood	*SLBP*	4	2.2871	0.022
Blood	*NEK1*	4	–2.2847	0.022
Blood	*TACC3*	4	2.2765	0.023
Blood	*BMP2K*	4	2.1690	0.030
Blood	*CLCN3*	4	2.1602	0.031
Blood	*RAPGEF2*	4	2.0480	0.041
Blood	*ANTXR2*	4	–2.8173	0.005
Blood	*N4BP2*	4	2.4389	0.015
Blood	*ZNF518B*	4	–2.4309	0.015
Blood	*ELF2*	4	–2.4234	0.015
Blood	*FAM53A*	4	–2.3423	0.019
Blood	*COQ2*	4	2.3138	0.021
Blood	*SRP72*	4	2.2994	0.022
Blood	*H2AFZ*	4	–2.0555	0.040
Blood	*CRIPAK*	4	–1.9982	0.046
Blood	*SCFD2*	4	1.9841	0.047
Blood	*STIM2*	4	–1.9780	0.048
Blood	*GM2A*	5	2.7942	0.005
Blood	*BTNL9*	5	2.6611	0.008
Blood	*HINT1*	5	–2.3651	0.018
Blood	*REEP5*	5	2.2231	0.026
Blood	*KLHL3*	5	2.2205	0.026
Blood	*CENPK*	5	2.1642	0.031
Blood	*CCDC125*	5	2.0498	0.040
Blood	*CDK7*	5	3.4976	< 0.001
Blood	*SLC12A7*	5	3.4347	< 0.001
Blood	*MRPS36*	5	3.2877	0.001
Blood	*TBCA*	5	–2.5811	0.010
Blood	*SRP19*	5	2.5540	0.011
Blood	*BRD9*	5	–2.5082	0.012
Blood	*AP3B1*	5	–2.4417	0.015
Blood	*CMYA5*	5	–2.4280	0.015
Blood	*ELL2*	5	2.3130	0.021
Blood	*MRPL36*	5	–2.2968	0.022
Blood	*PAPD4*	5	2.2520	0.024
Blood	*ERGIC1*	5	2.2254	0.026
Blood	*ERAP1*	5	2.2000	0.028
Blood	*MED10*	5	–2.1545	0.031
Blood	*GLRX*	5	2.1231	0.034
Blood	*DCBLD1*	6	–2.0913	0.037
Blood	*BTN3A2*	6	–2.8613	0.004
Blood	*MLLT4*	6	2.7768	0.006
Blood	*KIAA1919*	6	2.7275	0.006
Blood	*LMBRD1*	6	2.4624	0.014
Blood	*C6orf106*	6	2.1493	0.032
Blood	*AKIRIN2*	6	–2.0664	0.039
Blood	*FAM184A*	6	1.9727	0.049
Blood	*HLA-DPB1*	6	3.3054	< 0.001
Blood	*HIST1H4L*	6	–3.1370	0.002
Blood	*BTN2A2*	6	3.0573	0.002
Blood	*HIST1H2BF*	6	2.9049	0.004
Blood	*HLA-B*	6	–2.1409	0.032
Blood	*ZFP57*	6	2.0758	0.038
Blood	*BAT1*	6	–2.0448	0.041
Blood	*FLOT1*	6	1.9685	0.049
Blood	*BMP6*	6	–2.6908	0.007
Blood	*TREML2*	6	2.5745	0.010
Blood	*FANCE*	6	–2.4875	0.013
Blood	*LY86*	6	–2.2543	0.024
Blood	*FARS2*	6	2.1617	0.031
Blood	*RPP40*	6	–2.1611	0.031
Blood	*SNRPC*	6	–2.1426	0.032
Blood	*ENPP4*	6	2.0800	0.038
Blood	*UTRN*	6	2.0710	0.038
Blood	*PEX6*	6	2.0028	0.045
Blood	*QKI*	6	–2.0014	0.045
Blood	*ZKSCAN4*	6	2.9216	0.004
Blood	*ZSCAN16*	6	2.6598	0.008
Blood	*PGBD1*	6	2.6490	0.008
Blood	*HLA-DRB1*	6	–2.4706	0.014
Blood	*HCP5*	6	–2.3057	0.021
Blood	*B3GALT4*	6	2.1809	0.029
Blood	*CCDC146*	7	–2.7113	0.007
Blood	*SCRN1*	7	2.8160	0.005
Blood	*SGCE*	7	–2.5131	0.012
Blood	*NDUFB2*	7	–2.1900	0.029
Blood	*VWDE*	7	–2.0299	0.042
Blood	*POLR2J*	7	2.3347	0.020
Blood	*CLDN15*	7	2.1846	0.029
Blood	*CCDC126*	7	2.1135	0.035
Blood	*KLHDC10*	7	–2.0650	0.039
Blood	*LMTK2*	7	2.0420	0.041

(Continued)

Supplementary Table ii (Continued)

Tissue	Gene	CHR	Z_{TWAS}	P_{TWAS}*
Blood	*TBL2*	7	2.0322	0.042
Blood	*ASPH*	8	2.4963	0.013
Blood	*ERI1*	8	2.4833	0.013
Blood	*FDFT1*	8	–2.1453	0.032
Blood	*TRIM35*	8	2.0176	0.044
Blood	*UTP23*	8	1.9988	0.046
Blood	*SLA*	8	–2.4248	0.015
Blood	*MFHAS1*	8	–2.1362	0.033
Blood	*FAM91A1*	8	2.1025	0.036
Blood	*PLIN2*	9	–3.5411	< 0.001
Blood	*STX17*	9	–2.4546	0.014
Blood	*FAM125B*	9	–2.3821	0.017
Blood	*SPAG8*	9	–3.2190	0.001
Blood	*NUDT2*	9	2.2383	0.025
Blood	*IL11RA*	9	–2.1774	0.030
Blood	*PGM5*	9	–2.1290	0.033
Blood	*TRIM8*	10	2.3936	0.017
Blood	*CCDC7*	10	2.3965	0.017
Blood	*CDC123*	10	2.3695	0.018
Blood	*YME1L1*	10	2.3555	0.019
Blood	*ACTR1A*	10	2.2399	0.025
Blood	*ECD*	10	2.0220	0.043
Blood	*ANK3*	10	2.0007	0.045
Blood	*CHST15*	10	3.2628	0.001
Blood	*OPTN*	10	–3.1452	0.002
Blood	*DIP2C*	10	3.1405	0.002
Blood	*PTPLA*	10	–2.6524	0.008
Blood	*LARP4B*	10	–2.6344	0.008
Blood	*TSPAN14*	10	2.5519	0.011
Blood	*EPC1*	10	–2.4934	0.013
Blood	*TM9SF3*	10	2.3864	0.017
Blood	*AFAP1L2*	10	2.3477	0.019
Blood	*ARHGAP21*	10	–2.3135	0.021
Blood	*SMNDC1*	10	–2.2187	0.027
Blood	*ARHGAP22*	10	–2.0373	0.042
Blood	*BTRC*	10	–2.0352	0.042
Blood	*MAP3K8*	10	–1.9705	0.049
Blood	*PAK1*	11	2.8271	0.005
Blood	*FLI1*	11	–2.8408	0.005
Blood	*SPON1*	11	2.6982	0.007
Blood	*MS4A14*	11	–2.2164	0.027
Blood	*FAM89B*	11	–2.5522	0.011
Blood	*LRFN4*	11	–2.5445	0.011
Blood	*ANKK1*	11	–2.4693	0.014
Blood	*NRIP3*	11	–2.4099	0.016
Blood	*TALDO1*	11	–2.1851	0.029
Blood	*FOLR3*	11	–2.1637	0.031
Blood	*PAFAH1B2*	11	–2.1525	0.031
Blood	*COPB1*	11	2.1321	0.033
Blood	*CCDC90B*	11	2.0850	0.037
Blood	*CBL*	11	2.0815	0.037
Blood	*SIK3*	11	–2.0446	0.041
Blood	*JAM3*	11	2.0406	0.041
Blood	*TTC12*	11	–1.9965	0.046
Blood	*ARL6IP4*	12	2.9365	0.003
Blood	*GPR162*	12	–2.1750	0.030
Blood	*SBNO1*	12	3.1669	0.002
Blood	*CORO1C*	12	2.7905	0.005
Blood	*BCAT1*	12	2.7284	0.006
Blood	*KLRD1*	12	–2.6600	0.008
Blood	*SLC38A1*	12	–2.9363	0.003
Blood	*KLRAP1*	12	2.3550	0.019
Blood	*RAB3IP*	12	–2.2281	0.026
Blood	*PFDN5*	12	–2.0706	0.038
Blood	*RPAP3*	12	–2.0591	0.040
Blood	*EIF2B1*	12	–1.9667	0.049
Blood	*SSH1*	12	–3.7411	< 0.001
Blood	*UBE2N*	12	3.3246	< 0.001
Blood	*ZNF84*	12	–2.7585	0.006
Blood	*MPHOSPH9*	12	–2.7467	0.006
Blood	*ASB8*	12	–2.3082	0.021
Blood	*RDH5*	12	2.2617	0.024
Blood	*SMUG1*	12	–2.2602	0.024
Blood	*TUBA1C*	12	2.2195	0.027
Blood	*TRAFD1*	12	2.1932	0.028
Blood	*PWP1*	12	2.1555	0.031
Blood	*TBK1*	12	2.1509	0.032
Blood	*PPHLN1*	12	2.1259	0.034
Blood	*AMDHD1*	12	2.0774	0.038
Blood	*OAS3*	12	–2.0157	0.044
Blood	*SSPN*	12	2.0152	0.044
Blood	*CKAP2*	13	2.8469	0.004
Blood	*IFT88*	13	–1.9943	0.046
Blood	*MED4*	13	2.7741	0.006
Blood	*ESD*	13	2.6742	0.008
Blood	*VPS36*	13	2.2092	0.027
Blood	*SPRY2*	13	–2.2087	0.027
Blood	*HSPH1*	13	2.1040	0.035
Blood	*SUCLA2*	13	2.0358	0.042
Blood	*MTIF3*	13	2.0090	0.045
Blood	*SNX6*	14	–2.0387	0.042
Blood	*DCAF4*	14	1.9825	0.047
Blood	*METTL3*	14	–2.8266	0.005
Blood	*ATP6V1D*	14	–2.7888	0.005
Blood	*HSP90AA1*	14	2.6276	0.009
Blood	*SRP54*	14	2.4795	0.013
Blood	*CINP*	14	–2.2976	0.022
Blood	*TOX4*	14	–2.2325	0.026
Blood	*ANKRD9*	14	2.1031	0.036
Blood	*PSMA6*	14	–2.0037	0.045
Blood	*USP8*	15	–2.7604	0.006
Blood	*ANKDD1A*	15	2.5675	0.010
Blood	*MAN2C1*	15	–2.5220	0.012
Blood	*PATL2*	15	–2.4690	0.014
Blood	*SLC12A1*	15	–2.2688	0.023
Blood	*FMN1*	15	2.2666	0.023
Blood	*CTXN2*	15	–2.2336	0.026
Blood	*SCAMP2*	15	2.1766	0.030
Blood	*MYEF2*	15	–2.0680	0.039
Blood	*SEMA4B*	15	2.8553	0.004
Blood	*BLM*	15	–2.7670	0.006
Blood	*TRIM69*	15	–2.7576	0.006
Blood	*IMP3*	15	2.3607	0.018
Blood	*DUT*	15	–2.3585	0.018
Blood	*MYO5A*	15	2.3025	0.021
Blood	*FAM103A1*	15	–2.2879	0.022
Blood	*SNUPN*	15	–2.1576	0.031
Blood	*DET1*	15	2.1381	0.033
Blood	*PLA2G4B*	15	2.0168	0.044
Blood	*RBL2*	16	2.1859	0.029
Blood	*MTHFSD*	16	–3.4959	< 0.001
Blood	*INO80E*	16	–2.8015	0.005
Blood	*RPL13*	16	3.0844	0.002
Blood	*GALNS*	16	2.2831	0.022
Blood	*MON1B*	16	2.0672	0.039
Blood	*ARL6IP1*	16	2.0316	0.042
Blood	*MAPK3*	16	–3.8468	< 0.001
Blood	*FBXL16*	16	3.4551	< 0.001
Blood	*ITFG3*	16	–3.1179	0.002
Blood	*PPP4C*	16	–2.7785	0.006
Blood	*SPATA2L*	16	–2.5690	0.010
Blood	*DOK4*	16	2.4491	0.014
Blood	*CBFA2T3*	16	–2.1747	0.030
Blood	*CHMP1A*	16	–2.1525	0.031
Blood	*HBQ1*	16	2.1153	0.034
Blood	*AKTIP*	16	–2.0445	0.041
Blood	*HBM*	16	2.0365	0.042
Blood	*TRAPPC2L*	16	1.9763	0.048

(Continued)

Supplementary Table ii (Continued)

Tissue	Gene	CHR	Z_{TWAS}	P_{TWAS}*
Blood	*SAT2*	17	–2.5632	0.010
Blood	*MPP2*	17	–2.5094	0.012
Blood	*NFE2L1*	17	3.0869	0.002
Blood	*C17orf68*	17	3.0234	0.003
Blood	*ACTG1*	17	2.6193	0.009
Blood	*ERN1*	17	2.5499	0.011
Blood	*TMUB2*	17	–2.3937	0.017
Blood	*MPO*	17	2.3258	0.020
Blood	*RNF43*	17	2.1527	0.031
Blood	*GSDMA*	17	2.1499	0.032
Blood	*NPEPPS*	17	–2.0733	0.038
Blood	*FAM134C*	17	–1.9664	0.049
Blood	*G6PC3*	17	3.1982	0.001
Blood	*HOXB4*	17	2.7834	0.005
Blood	*EVI2B*	17	2.6904	0.007
Blood	*SGCA*	17	–2.6310	0.009
Blood	*ITGAE*	17	–2.4447	0.015
Blood	*MYH3*	17	2.3957	0.017
Blood	*HEATR6*	17	2.3942	0.017
Blood	*HOXB2*	17	2.3376	0.019
Blood	*TAX1BP3*	17	–2.1257	0.034
Blood	*PSMB3*	17	2.0946	0.036
Blood	*TMEM107*	17	2.0873	0.037
Blood	*PSMB6*	17	1.9630	0.050
Blood	*SPIRE1*	18	2.3690	0.018
Blood	*PPP4R1*	18	2.2759	0.023
Blood	*SEC11C*	18	2.1067	0.035
Blood	*RAB31*	18	–2.0343	0.042
Blood	*LPAR2*	19	2.4549	0.014
Blood	*GPX4*	19	3.6084	< 0.001
Blood	*FPR1*	19	–2.5509	0.011
Blood	*C19orf22*	19	–2.4155	0.016
Blood	*ZFP28*	19	2.3187	0.020
Blood	*CYP4F12*	19	2.2210	0.026
Blood	*IFI30*	19	1.9801	0.048
Blood	*RPL13A*	19	3.2408	0.001
Blood	*PBX4*	19	–2.9869	0.003
Blood	*GMIP*	19	–2.9223	0.004
Blood	*ZNF324*	19	2.8287	0.005
Blood	*CCDC124*	19	–2.8220	0.005
Blood	*ZNF529*	19	–2.2671	0.023
Blood	*ZNF470*	19	2.2214	0.026
Blood	*FCHO1*	19	2.1981	0.028
Blood	*Mar2*	19	–2.1754	0.030
Blood	*BSG*	19	–2.1002	0.036
Blood	*RPL36*	19	–2.0682	0.039
Blood	*ZNF121*	19	2.0495	0.040
Blood	*TYK2*	19	1.9664	0.049
Blood	*UQCC*	20	3.9040	< 0.001
Blood	*PCMTD2*	20	3.4227	< 0.001
Blood	*YWHAB*	20	3.1375	0.002
Blood	*BFSP1*	20	2.8071	0.005
Blood	*PIGT*	20	–3.0792	0.002
Blood	*DSTN*	20	2.8559	0.004
Blood	*CEP250*	20	2.6770	0.007
Blood	*PABPC1L*	20	2.5879	0.010
Blood	*OPRL1*	20	–2.5553	0.011
Blood	*RRBP1*	20	2.3106	0.021
Blood	*TTPAL*	20	2.3018	0.021
Blood	*SNRPB*	20	–2.1377	0.033
Blood	*PROCR*	20	2.0904	0.037
Blood	*TP53INP2*	20	–2.0599	0.039
Blood	*GMEB2*	20	–1.9804	0.048
Blood	*RWDD2B*	21	–4.1737	< 0.001
Blood	*N6AMT1*	21	–3.8769	< 0.001
Blood	*NCRNA00189*	21	–2.9174	0.004
Blood	*C21orf7*	21	2.6083	0.009
Blood	*CCT8*	21	–2.7620	0.006
Blood	*TMEM50B*	21	2.6807	0.007
Blood	*SLC37A1*	21	2.4783	0.013
Blood	*MORC3*	21	–2.0901	0.037
Blood	*SNRPD3*	22	–2.3113	0.021
Blood	*YWHAH*	22	2.2441	0.025
Blood	*C22orf34*	22	2.4078	0.016
Blood	*PVALB*	22	–2.1789	0.029
Blood	*CRKL*	22	–2.5701	0.010
Blood	*LARGE*	22	2.1550	0.031
Blood	*LGALS1*	22	2.1550	0.031
Blood	*CBX7*	22	2.0778	0.038
Blood	*RRP7A*	22	–2.0522	0.040
Blood	*ASCC2*	22	–2.0026	0.045
Blood	*PDXP*	22	1.9883	0.047

*Each PTWAS value was calculated by transcriptome-wide association study analysis.
CHR, chromosome; TWAS, transcriptome-wide association study.

Supplementary Table iii. Gene ontology and pathway enrichment analysis results of the significant genes identified by transcriptome-wide association studies for hip osteoarthritis.

Category	Tissue	Term	p-value*
GO	Skeletal muscle	GO:0071567~UFM1 hydrolase activity	0.016
		GO:0000077~DNA damage checkpoint	0.019
		GO:0008427~calcium-dependent protein kinase inhibitor activity	0.023
		GO:0098641~cadherin binding involved in cell-cell adhesion	0.027
		GO:0019901~protein kinase binding	0.028
		GO:0009113~purine nucleobase biosynthetic process	0.035
		GO:0005913~cell-cell adherens junction	0.037
		GO:0006355~regulation of transcription, DNA-templated	0.039
		GO:0016740~transferase activity	0.040
		GO:0008270~zinc ion binding	0.040
		GO:0042470~melanosome	0.041
	Blood	GO:0016020~membrane	< 0.001
		GO:0001574~ganglioside biosynthetic process	< 0.001
		GO:0000139~Golgi membrane	< 0.001
		GO:0008373~sialyltransferase activity	< 0.001
		GO:0005794~Golgi apparatus	< 0.001
		GO:0097503~sialylation	< 0.001
		GO:0009311~oligosaccharide metabolic process	0.001
		GO:0030097~hemopoiesis	0.006
		GO:0006486~protein glycosylation	0.007
		GO:0003836~beta-galactoside (CMP) alpha-2,3-sialyltransferase activity	0.008
		GO:0018279~protein N-linked glycosylation via asparagine	0.008
		GO:0005515~protein binding	0.008
		GO:0008270~zinc ion binding	0.009
		GO:0016740~transferase activity	0.012
		GO:0030206~chondroitin sulfate biosynthetic process	0.013
		GO:0032580~Golgi cisterna membrane	0.015
		GO:0001893~maternal placenta development	0.016
		GO:0005925~focal adhesion	0.018
		GO:0035195~gene silencing by miRNA	0.019
		GO:0070062~extracellular exosome	0.019
		GO:0043085~positive regulation of catalytic activity	0.021
		GO:0005789~endoplasmic reticulum membrane	0.024
		GO:0030307~positive regulation of cell growth	0.025
		GO:0005654~nucleoplasm	0.031
		GO:0042254~ribosome biogenesis	0.033
		GO:0019901~protein kinase binding	0.036
		GO:0021691~cerebellar Purkinje cell layer maturation	0.039
		GO:0001934~positive regulation of protein phosphorylation	0.039
		GO:0006487~protein N-linked glycosylation	0.041
		GO:0006171~cAMP biosynthetic process	0.043
		GO:0016301~kinase activity	0.049
Pathway	Blood	hsa00532:Glycosaminoglycan biosynthesis - chondroitin sulfate / dermatan sulfate	0.006
		hsa04976:Bile secretion	0.010
		hsa04151:PI3K-Akt signalling pathway	0.033
		h_rarPathway:Degradation of the RAR and RXR by the proteasome	0.046

*Each p value of each single nucleotide polymorphism was calculated by gene ontology and pathway analysis using DAVID for the significant genes identified by transcriptome-wide association study analysis.
cAMP, cyclic AMP; CMP, cytidine monophosphate; GO, gene ontology; miRNA, microRNA; PI3K-Akt, hosphatidylinositol 3' -kinase-protein kinase B; RAR, retinoic acid receptor; RXR, retinoid X receptor; UFM1, (ubiquitin-fold modifier 1).

Supplementary Table iv. Gene ontology and pathway enrichment analysis results of the significant genes identified by transcriptome-wide association studies for knee osteoarthritis.

Category	Tissue	Term	p-value*
GO	Skeletal muscle	GO:0005515~protein binding	< 0.001
		GO:0044822~poly(A) RNA binding	0.013
		GO:0098641~cadherin binding involved in cell-cell adhesion	0.017
		GO:0005913~cell-cell adherens junction	0.030
		GO:0006614~SRP-dependent cotranslational protein targeting to membrane	0.031
		GO:0043234~protein complex	0.031
		GO:0005840~ribosome	0.033
		GO:0006464~cellular protein modification process	0.040
		GO:0098609~cell-cell adhesion	0.046
		GO:0019083~viral transcription	0.047
	Blood	GO:0005829~cytosol	< 0.001
		GO:0044822~poly(A) RNA binding	< 0.001
		GO:0005515~protein binding	< 0.001
		GO:0016010~dystrophin-associated glycoprotein complex	< 0.001
		GO:0005737~cytoplasm	< 0.001
		GO:0016020~membrane	< 0.001
		GO:0042383~sarcolemma	0.002
		GO:0019369~arachidonic acid metabolic process	0.002
		GO:0070062~extracellular exosome	0.002
		GO:0071208~histone pre-mRNA DCP binding	0.003
		GO:0050852~T cell receptor signalling pathway	0.004
		GO:0030176~integral component of endoplasmic reticulum membrane	0.005
		GO:0005794~Golgi apparatus	0.006
		GO:0005786~signal recognition particle, endoplasmic reticulum targeting	0.006
		GO:0071204~histone pre-mRNA 3'end processing complex	0.006
		GO:0006616~SRP(Signal-Recognition Particle) -dependent cotranslational protein targeting to membrane, translocation	0.006
		GO:0005769~early endosome	0.007
		GO:0016023~cytoplasmic, membrane-bounded vesicle	0.007
		GO:0008312~7S RNA binding	0.008
		GO:0031410~cytoplasmic vesicle	0.009
		GO:0005856~cytoskeleton	0.009
		GO:0017124~SH3 domain binding	0.012
		GO:0006479~protein methylation	0.012
		GO:0038061~NIK/NF-kappaB signalling	0.013
		GO:0014704~intercalated disc	0.013
		GO:0016600~flotillin complex	0.014
		GO:0008022~protein C-terminus binding	0.014
		GO:0015629~actin cytoskeleton	0.014
		GO:0006614~SRP(Signal-Recognition Particle)-dependent cotranslational protein targeting to membrane	0.014
		GO:0016192~vesicle-mediated transport	0.015
		GO:0006468~protein phosphorylation	0.017
		GO:0060333~interferon-gamma-mediated signalling pathway	0.017
		GO:0043001~Golgi to plasma membrane protein transport	0.019
		GO:0005840~ribosome	0.020
		GO:0000387~spliceosomal snRNP assembly	0.021
		GO:0002223~stimulatory C-type lectin receptor signalling pathway	0.023
		GO:0042623~ATPase activity, coupled	0.025
		GO:0008334~histone mRNA metabolic process	0.025
		GO:0005730~nucleolus	0.027
		GO:0061024~membrane organization	0.029
		GO:0046982~protein heterodimerization activity	0.033
		GO:0000139~Golgi membrane	0.034
		GO:0038095~Fc-epsilon receptor signalling pathway	0.035
		GO:0005815~microtubule organizing centre	0.037
		GO:0097226~sperm mitochondrial sheath	0.040
		GO:0071207~histone pre-mRNA stem-loop binding	0.041
		GO:0030658~transport vesicle membrane	0.042
		GO:0006412~translation	0.042
		GO:0031585~regulation of inositol 1,4,5-trisphosphate-sensitive calcium-release channel activity	0.042
		GO:0006617~SRP-dependent cotranslational protein targeting to membrane, signal sequence recognition	0.042
		GO:0003735~structural constituent of ribosome	0.042
		GO:0005764~lysosome	0.042
		GO:0070034~telomerase RNA binding	0.042
		GO:0043234~protein complex	0.043
		GO:0030027~lamellipodium	0.045
		GO:0000980~RNA polymerase II distal enhancer sequence-specific DNA binding	0.045

(Continued)

Supplementary Table iv (Continued)

Category	Tissue	Term	p-value*
		GO:0001948~glycoprotein binding	0.045
		GO:0030048~actin filament-based movement	0.049
Pathway	Skeletal muscle	hsa04610: Complement and coagulation cascades	0.017
	Blood	hsa05164: Influenza A	0.006
		hsa04660: T cell receptor signalling pathway	0.009
		hsa05416: Viral myocarditis	0.009
		hsa04012: ErbB signalling pathway	0.014
		hsa04144: Endocytosis	0.014
		hsa03060: Protein export	0.014
		hsa05211: Renal cell carcinoma	0.015
		h_pyk2Pathway: Links between Pyk2 and Map Kinases	0.026
		hsa04612: Antigen processing and presentation	0.028
		h_PparaPathway:Mechanism of Gene Regulation by Peroxisome Proliferators via PPARa	0.031
		hsa04910: Insulin signalling pathway	0.036
		h_smPathway:Spliceosomal Assembly	0.041
		hsa05203: Viral carcinogenesis	0.042
		h_metPathway:Signalling of Hepatocyte Growth Factor Receptor	0.050

*Each p value of each single nucleotide polymorphism was calculated by gene ontology and pathway analysis using DAVID for the significant genes identified by transcriptome-wide association study analysis.
ATPase, adenosine triphosphatase; DCP, downstream cleavage product; ErbB, tyrosine kinase receptor; GO, gene ontology; Map, mitogen-activated protein; mRNA, messenger RNA; NIK/NF-kappaB, NF-KappaB-inducing kinase/noncanonical nuclear factor kappaB; PPARa, peroxisome proliferator activated receptor alpha; Pyk2, proline-rich tyrosine kinase 2; SH3, Src homology 3; snRNP, small nuclear ribonucleoprotein; SRP, signal-recognition particle.