

Table S11. 80 Gene Signature for NMF Cluster 1 (LAR).

Gene	Discovery			Validation		Disagreement
	Centroid	log2(FC)	BH p	log2(FC)	BH p	
DHRS2	0.898	5.7514	<0.0001	4.1403	<0.0001	
GABRP	0.255	-4.8029	<0.0001	-3.4839	<0.0001	
AGR2	0.979	4.2769	<0.0001	3.1220	<0.0001	
PIP	0.997	4.0699	<0.0001	3.7343	<0.0001	
FOXA1	0.954	3.9340	<0.0001	3.9921	<0.0001	
PROM1	0.180	-3.8163	<0.0001	-3.1031	<0.0001	
TFF1	0.953	3.6204	<0.0001	3.1180	<0.0001	
NAT1	0.980	3.5699	<0.0001	2.6271	<0.0001	
BCL11A	0.099	-3.5575	<0.0001	-2.6484	<0.0001	
ESR1	0.990	3.4541	<0.0001	3.2165	<0.0001	
FOXC1	0.514	-3.4283	<0.0001	-2.8732	<0.0001	
CA12	0.982	3.4096	<0.0001	2.9266	<0.0001	
TFF3	0.888	3.3892	<0.0001	3.1629	<0.0001	
SCUBE2	0.905	3.2993	<0.0001	2.2974	0.0001	
SFRP1	0.359	-3.2837	<0.0001	-1.7762	0.0006	
ERBB4	0.783	3.2586	<0.0001	2.8847	<0.0001	
SIDT1	0.655	3.1734	<0.0001	2.4519	<0.0001	
PSAT1	0.415	-3.1627	<0.0001	-3.2799	<0.0001	
CHI3L1	0.404	-3.1076	<0.0001	-2.5469	<0.0001	
AR	0.969	3.0784	<0.0001	2.7891	<0.0001	
CD36	0.714	0.3385	0.7776	0.2878	0.8216	Non-Sig for Cluster
OGN	0.720	1.5715	0.0405	0.9189	0.3672	P-value
ABCA8	0.193	0.1829	0.8640	0.4191	0.7178	Non-Sig for Cluster
CFD	0.821	0.4400	0.6134	0.4311	0.6257	Non-Sig for Cluster
IGF1	0.751	0.5794	0.5440	0.5013	0.6305	Non-Sig for Cluster
HBB	0.698	-0.0403	0.9678	-0.1228	0.9194	Non-Sig for Cluster
CDH1	0.995	1.5030	0.0092	0.8275	0.0824	P-value
MEOX2	0.120	-0.3409	0.5921	-0.1060	0.9158	Non-Sig for Cluster
GPX3	0.845	-0.0683	0.9453	-0.2508	0.7791	Non-Sig for Cluster
SCARA5	0.059	-0.3304	0.6319	-0.3794	0.6293	Non-Sig for Cluster
PDK4	0.833	0.4061	0.6189	0.1979	0.8747	Non-Sig for Cluster
ENPP2	0.739	-0.3986	0.5756	-0.5869	0.4203	Non-Sig for Cluster
AGTR1	0.477	1.4623	0.0192	1.0300	0.1098	P-value
LEP	0.239	-0.0091	0.9931	-0.4756	0.3953	Non-Sig for Cluster
LPL	0.465	-1.0800	0.1317	-1.3093	0.0362	P-value
DPT	0.788	0.2979	0.7090	0.0918	0.9392	Non-Sig for Cluster
TIMP4	0.269	-0.2480	0.7494	0.2282	0.7149	Non-Sig for Cluster
FHL1	0.960	0.3791	0.5962	-0.1029	0.9202	Non-Sig for Cluster
SRPX	0.806	-0.4037	0.4593	-0.5410	0.3662	Non-Sig for Cluster
EDNRB	0.208	-0.2496	0.7281	0.0436	0.9635	Non-Sig for Cluster
SERPINB5	0.179	-2.8518	<0.0001	-2.5727	<0.0001	
SOX10	0.242	-2.2086	<0.0001	-1.6822	0.0034	
IRX1	0.405	-1.7639	0.0014	-1.2325	0.0243	
MIA	0.450	-1.8192	0.0001	-1.1835	0.0045	
DSC2	0.370	-1.6308	0.0001	-1.4606	0.0012	
TTYH1	0.183	-1.2789	0.0064	-0.6706	0.1999	P-value
COL9A3	0.445	-0.8126	0.0879	-1.0409	0.0267	P-value
FGL2	0.626	-0.1369	0.8357	-0.3854	0.5813	Non-Sig for Cluster
RARRES3	0.799	1.1437	0.0019	0.6987	0.1412	P-value
PDE9A	0.305	-1.2099	0.0003	-0.7312	0.0274	
BST2	0.931	0.8032	0.0264	-0.3509	0.4448	P-value
PTGER4	0.780	-0.2452	0.6212	-0.5807	0.2371	Non-Sig for Cluster
KCNK5	0.398	-1.3955	<0.0001	-1.0680	0.0011	
PSMB9	0.929	-0.4441	0.2652	-1.1009	0.0053	P-value
HLA-DMA	0.863	-0.1804	0.7103	-0.4929	0.3366	Non-Sig for Cluster
EPHB3	0.452	-0.8312	0.0036	-0.4842	0.1820	P-value
IGSF6	0.572	0.0411	0.9391	-0.1828	0.7859	Non-Sig for Cluster
ST3GAL6	0.225	-1.0676	0.0002	-1.0298	0.0044	
RHOH	0.599	1.0482	0.0001	0.6574	0.0631	P-value
SGPP1	0.616	0.3583	0.2590	-0.1078	0.8169	Non-Sig for Cluster
CXCL9	0.868	-0.5119	0.5580	-0.8955	0.2291	Non-Sig for Cluster
CXCL11	0.225	-0.7021	0.3754	-1.4925	0.0260	P-value
GBP5	0.311	-0.8121	0.0775	-1.1882	0.0114	P-value
GZMB	0.272	-1.1408	0.0171	-1.6132	0.0024	
LAMP3	0.549	-1.8756	0.0004	-1.9738	0.0001	
GBP1	0.869	-1.0792	0.0212	-1.5404	0.0003	
ADAMDEC1	0.319	-0.6300	0.3361	-1.4213	0.0164	P-value
CCL5	0.586	-1.0136	0.0338	-1.3653	0.0217	
SPON1	0.736	0.3249	0.633	0.0778	0.9395	Non-Sig for Cluster
PBK	0.473	-0.8333	0.0775	-0.5441	0.3173	Non-Sig for Cluster

Table S11. 80 Gene Signature for NMF Cluster 1 (LAR).

Gene	Discovery			Validation		
	Centroid	log2(FC)	BH p	log2(FC)	BH p	Disagreement
STAT1	0.813	-0.3598	0.4413	-0.6906	0.0495	P-value
EZH2	0.636	-0.9491	0.0413	-0.9060	0.0388	
PLAT	0.841	1.5062	0.0005	1.2419	0.0188	
TAP2	0.651	-1.1116	0.0013	-1.3551	0.0001	
SLAMF7	0.397	-0.6443	0.1432	-0.7794	0.1063	Non-Sig for Cluster
HERC5	0.584	-1.0633	0.0032	-0.7327	0.0573	P-value
SPOCK1	0.845	1.0936	0.0053	0.5007	0.3031	P-value
TAP1	0.864	-0.5837	0.0784	-1.0116	0.0020	P-value
CD2	0.655	-0.3370	0.5120	-0.6427	0.2184	Non-Sig for Cluster
AIM2	0.372	-0.7104	0.0397	-1.1337	0.0089	

Table S12. 80 Gene Signature for NMF Cluster 2 (MES).

Gene	Discovery			Validation		Disagreement
	Centroid	log2(FC)	BH p	log2(FC)	BH p	
DHRS2	0.036	-1.3389	0.2277	-0.1477	0.8545	Non-Sig for Cluster
GABRP	0.770	-0.9586	0.4143	-1.2552	0.0619	Non-Sig for Cluster
AGR2	0.372	-0.5700	0.5571	0.4801	0.4031	Non-Sig for Cluster
PIP	0.592	-0.7620	0.4501	1.5092	0.0100	P-value
FOXA1	0.369	-0.8285	0.2575	-0.0577	0.9207	Non-Sig for Cluster
PROM1	0.772	-1.0635	0.2831	-0.6004	0.3636	Non-Sig for Cluster
TFF1	0.438	-0.3839	0.6867	0.1301	0.8214	Non-Sig for Cluster
NAT1	0.662	-0.2979	0.7415	0.5270	0.1640	Non-Sig for Cluster
BCL11A	0.579	-0.2960	0.7536	-0.8829	0.0436	P-value
ESR1	0.648	0.0115	0.9919	1.0733	0.0553	Non-Sig for Cluster
FOXC1	0.879	-0.6057	0.4388	-0.3631	0.4208	Non-Sig for Cluster
CA12	0.820	0.1791	0.8533	0.1638	0.7517	Non-Sig for Cluster
TFF3	0.333	-0.3207	0.6978	0.3968	0.4127	Non-Sig for Cluster
SCUBE2	0.622	0.6116	0.4834	1.4198	0.0006	P-value
SFRP1	0.926	1.1057	0.1328	0.2929	0.5403	Non-Sig for Cluster
ERBB4	0.143	-0.0830	0.9358	0.4586	0.3810	Non-Sig for Cluster
SIDT1	0.123	-0.5534	0.3767	1.1058	0.0023	P-value
PSAT1	0.845	0.0462	0.9624	-0.3292	0.5683	Non-Sig for Cluster
CHI3L1	0.784	0.0719	0.9464	-0.0509	0.9335	Non-Sig for Cluster
AR	0.737	0.0385	0.9686	1.1753	0.0043	P-value
CD36	0.972	3.7594	<0.0001	3.6037	<0.0001	
OGN	0.929	3.5236	<0.0001	4.1934	<0.0001	
ABCA8	0.865	3.4919	<0.0001	3.6937	<0.0001	
CFD	0.992	3.3265	<0.0001	2.9414	<0.0001	
IGF1	0.983	3.3191	<0.0001	3.6258	<0.0001	
HBB	0.965	2.8014	<0.0001	2.6778	<0.0001	
CDH1	0.953	-2.7729	<0.0001	-0.9126	0.0034	
MEOX2	0.611	2.7604	<0.0001	2.8253	<0.0001	
GPX3	0.987	2.7526	<0.0001	2.7071	<0.0001	
SCARA5	0.579	2.7414	<0.0001	2.7977	<0.0001	
PDK4	0.974	2.7287	<0.0001	3.0872	<0.0001	
ENPP2	0.966	2.6740	<0.0001	2.4853	<0.0001	
AGTR1	0.624	2.6613	<0.0001	2.5264	<0.0001	
LEP	0.540	2.6279	<0.0001	1.8442	<0.0001	
LPL	0.944	2.6248	<0.0001	1.7721	0.0001	
DPT	0.965	2.6172	<0.0001	2.9309	<0.0001	
TIMP4	0.597	2.5923	<0.0001	1.4645	<0.0001	
FHL1	0.991	2.5903	<0.0001	2.5296	<0.0001	
SRPX	0.967	2.5853	<0.0001	2.3282	<0.0001	
EDNRB	0.627	2.5630	<0.0001	2.0768	<0.0001	
SERPINB5	0.456	-1.7298	0.0233	-0.6943	0.1921	P-value
SOX10	0.526	-0.0393	0.9664	-1.0873	0.0143	P-value
IRX1	0.587	-0.1596	0.8554	0.0245	0.9642	Non-Sig for Cluster
MIA	0.566	-0.3287	0.6189	-0.5793	0.0763	Non-Sig for Cluster
DSC2	0.392	-1.4208	0.0028	-0.9528	0.0047	
TTYH1	0.255	-0.3244	0.6097	-0.7466	0.0313	P-value
COL9A3	0.452	-0.5722	0.2876	-0.4971	0.1753	Non-Sig for Cluster
FGL2	0.795	1.1650	0.0105	2.4429	<0.0001	
RARRES3	0.724	-0.2060	0.7058	0.9128	0.0031	P-value
PDE9A	0.409	-0.3788	0.4003	-0.2543	0.3462	Non-Sig for Cluster
BST2	0.889	-0.0604	0.9149	0.4820	0.0848	Non-Sig for Cluster
PTGER4	0.923	1.3144	0.0002	1.8291	<0.0001	
KCNK5	0.467	-0.6574	0.0982	-0.7058	0.0046	P-value
PSMB9	0.955	0.0598	0.9117	0.7882	0.0071	P-value
HLA-DMA	0.947	0.7267	0.0529	1.2600	<0.0001	P-value
EPHB3	0.494	-0.3559	0.3207	-0.5010	0.0396	P-value
IGSF6	0.579	0.2628	0.5476	1.4431	<0.0001	P-value
ST3GAL6	0.300	-0.3515	0.3547	-0.2481	0.4159	Non-Sig for Cluster
RHOH	0.451	-0.0620	0.8959	0.7347	0.0020	P-value
SGPP1	0.675	0.5774	0.0557	0.8744	<0.0001	P-value
CXCL9	0.843	-0.8535	0.2859	1.2284	0.0095	P-value
CXCL11	0.055	-1.7136	0.0125	0.9147	0.0716	P-value
GBP5	0.335	-0.5670	0.2772	0.6390	0.0761	Non-Sig for Cluster
GZMB	0.509	0.0494	0.9471	0.9316	0.0245	P-value
LAMP3	0.756	-1.1569	0.0627	0.4141	0.3833	Non-Sig for Cluster
GBP1	0.870	-0.4708	0.4215	0.7527	0.0338	P-value
ADAMDEC1	0.329	-0.4377	0.5419	0.7936	0.0812	Non-Sig for Cluster
CCL5	0.750	0.1006	0.8896	1.0935	0.0111	P-value
SPON1	0.925	1.8221	0.0002	2.1712	<0.0001	
PBK	0.274	-1.8722	<0.0001	-1.5265	<0.0001	

Table S12. 80 Gene Signature for NMF Cluster 2 (MES).

Gene	Discovery			Validation		
	Centroid	log2(FC)	BH p	log2(FC)	BH p	Disagreement
STAT1	0.716	-0.8527	0.0347	0.5332	0.0354	Direction
EZH2	0.379	-2.1776	<0.0001	-1.4227	<0.0001	
PLAT	0.780	0.5896	0.2944	1.2058	0.0012	P-value
TAP2	0.784	-0.3995	0.3825	0.3093	0.3084	Non-Sig for Cluster
SLAMF7	0.442	-0.0938	0.8796	1.2079	0.0001	P-value
HERC5	0.698	-0.5467	0.2170	0.5118	0.0699	Non-Sig for Cluster
SPOCK1	0.837	0.8642	0.0501	0.9037	0.0020	P-value
TAP1	0.876	-0.4360	0.2405	0.1642	0.5910	Non-Sig for Cluster
CD2	0.751	-0.0486	0.9383	1.2647	0.0001	P-value
AIM2	0.423	-0.0989	0.8469	0.2607	0.4792	Non-Sig for Cluster

Table S13. 80 Gene Signature for NMF Cluster 3 (BLIS).

Gene	Discovery			Validation		Disagreement
	Centroid	log2(FC)	BH p	log2(FC)	BH p	
DHRS2	0.041	-2.0061	0.0333	-1.3870	0.0286	
GABRP	0.989	3.3084	0.0002	2.4363	0.0001	
AGR2	0.329	-1.7454	0.0158	-1.7056	0.0006	
PIP	0.516	-1.5592	0.0549	-2.2372	0.0001	P-value
FOXA1	0.324	-1.5771	0.0088	-1.3835	0.0013	
PROM1	0.977	2.2868	0.0036	1.8918	0.0011	
TFF1	0.366	-1.3488	0.0470	-1.3468	0.0027	
NAT1	0.492	-1.6031	0.0082	-1.3685	<0.0001	
BCL11A	0.821	1.7562	0.0053	2.0450	<0.0001	
ESR1	0.391	-1.7175	0.0255	-2.4454	<0.0001	
FOXC1	0.983	2.2293	<0.0001	1.4980	0.0002	
CA12	0.474	-1.8313	0.0026	-1.4025	0.0006	
TFF3	0.291	-1.3977	0.0144	-1.2323	0.0038	
SCUBE2	0.294	-1.4119	0.0401	-1.2309	0.0042	
SFRP1	0.951	1.6044	0.0115	1.3370	0.0008	
ERBB4	0.086	-1.3676	0.0346	-0.9887	0.0396	
SIDT1	0.069	-1.6772	0.0005	-2.0188	<0.0001	
PSAT1	0.897	0.7969	0.2575	1.4667	0.0029	P-value
CHI3L1	0.900	1.2037	0.0961	0.0786	0.9090	Non-Sig for Cluster
AR	0.539	-1.1501	0.0720	-1.2847	0.0024	P-value
CD36	0.348	-1.6388	0.0491	-2.0679	0.0003	
OGN	0.140	-1.8272	0.0126	-2.0965	0.0007	
ABCA8	0.056	-1.4063	0.0436	-1.7925	0.0020	
CFD	0.596	-1.7197	0.0062	-1.7507	0.0002	
IGF1	0.419	-1.2865	0.0965	-1.9174	0.0005	P-value
HBB	0.547	-0.9536	0.1344	-1.5836	0.0015	P-value
CDH1	0.991	0.8253	0.1695	0.4089	0.2631	Non-Sig for Cluster
MEOX2	0.084	-1.0717	0.0229	-1.3006	0.0016	
GPX3	0.679	-0.8973	0.1812	-1.5283	0.0002	P-value
SCARA5	0.031	-0.9544	0.0609	-1.2752	0.0024	P-value
PDK4	0.686	-0.6903	0.3261	-1.5161	0.0054	P-value
ENPP2	0.563	-1.5667	0.0015	-1.1484	0.0086	
AGTR1	0.108	-1.3760	0.0270	-1.4081	0.0015	
LEP	0.231	-0.9443	0.1141	-0.7915	0.0202	P-value
LPL	0.852	0.0876	0.9352	0.1118	0.8668	Non-Sig for Cluster
DPT	0.586	-1.3126	0.0182	-1.4955	0.0019	
TIMP4	0.238	-0.9011	0.0953	-0.8581	0.0060	P-value
FHL1	0.901	-0.7961	0.1746	-0.5255	0.2813	Non-Sig for Cluster
SRPX	0.779	-0.4257	0.4170	-0.6656	0.0867	Non-Sig for Cluster
EDNRB	0.132	-0.7248	0.1826	-0.9496	0.0111	P-value
SERPINB5	0.924	2.5530	<0.0001	2.0264	<0.0001	
SOX10	0.889	2.2620	<0.0001	2.3116	<0.0001	
IRX1	0.900	2.2561	<0.0001	1.4844	0.0001	
MIA	0.828	1.7548	<0.0001	1.6397	<0.0001	
DSC2	0.849	1.7446	<0.0001	1.4335	<0.0001	
TTYH1	0.542	1.6243	<0.0001	1.6915	<0.0001	
COL9A3	0.738	1.6010	<0.0001	1.5931	<0.0001	
FGL2	0.409	-1.5691	<0.0001	-1.8148	<0.0001	
RARRES3	0.494	-1.4268	<0.0001	-1.7794	<0.0001	
PDE9A	0.665	1.4229	<0.0001	0.6614	0.0060	
BST2	0.748	-1.3008	<0.0001	-1.0598	<0.0001	
PTGER4	0.711	-1.2771	<0.0001	-0.9853	0.0016	
KCNK5	0.756	1.2616	<0.0001	1.1839	<0.0001	
PSMB9	0.897	-1.1917	<0.0001	-1.0619	0.0001	
HLA-DMA	0.826	-1.1875	<0.0001	-1.4845	<0.0001	
EPHB3	0.703	1.1675	<0.0001	0.9823	0.0001	
IGSF6	0.423	-1.1352	<0.0001	-1.3228	<0.0001	
ST3GAL6	0.505	1.1338	<0.0001	1.1356	<0.0001	
RHOH	0.323	-1.0375	<0.0001	-1.0471	<0.0001	
SGPP1	0.517	-0.9756	<0.0001	-0.7023	0.0006	
CXCL9	0.869	-1.5057	0.0228	-1.1040	0.0267	
CXCL11	0.371	-0.7386	0.3317	-1.2224	0.0152	P-value
GBP5	0.308	-1.1590	0.0064	-1.0193	0.0034	
GZMB	0.274	-1.2592	0.0064	-1.1844	0.0042	
LAMP3	0.796	0.2571	0.7480	-0.6724	0.1436	Non-Sig for Cluster
GBP1	0.849	-0.8401	0.0858	-0.5927	0.1198	Non-Sig for Cluster
ADAMDEC1	0.364	-1.0673	0.0579	-0.7561	0.1092	Non-Sig for Cluster
CCL5	0.593	-0.9475	0.0474	-1.5986	0.0001	
SPON1	0.752	0.1654	0.8229	-0.5075	0.2789	Non-Sig for Cluster
PBK	0.676	0.316	0.5884	1.0485	0.0018	P-value

Table S13. 80 Gene Signature for NMF Cluster 3 (BLIS).

Gene	Discovery			Validation		
	Centroid	log2(FC)	BH p	log2(FC)	BH p	Disagreement
STAT1	0.753	-0.7945	0.0353	-0.5073	0.0541	P-value
EZH2	0.835	0.6614	0.1861	0.8525	0.0076	P-value
PLAT	0.689	-0.0303	0.9696	-0.5820	0.1762	Non-Sig for Cluster
TAP2	0.801	-0.3477	0.4430	-0.4286	0.1527	Non-Sig for Cluster
SLAMF7	0.340	-0.9533	0.0161	-1.1718	0.0001	
HERC5	0.703	-0.2767	0.5697	-0.6684	0.0166	P-value
SPOCK1	0.734	0.0241	0.9717	0.2299	0.5436	Non-Sig for Cluster
TAP1	0.871	-0.704	0.024	-0.5332	0.0486	
CD2	0.551	-1.1577	0.0018	-1.3038	<0.0001	
AIM2	0.392	-0.7829	0.0184	-0.9156	0.0044	

Table S14. 80 Gene Signature for NMF Cluster 4 (BLIA).

Gene	Discovery			Validation		Disagreement
	Centroid	log2(FC)	BH p	log2(FC)	BH p	
DHRS2	0.033	-1.8699	0.0422	-1.1893	0.0923	P-value
GABRP	0.977	1.3857	0.1615	1.0456	0.1745	Non-Sig for Cluster
AGR2	0.300	-1.4356	0.0480	-0.7864	0.1890	P-value
PIP	0.513	-1.3138	0.1054	-1.7149	0.0087	P-value
FOXA1	0.312	-1.1355	0.0649	-1.1852	0.0132	P-value
PROM1	0.948	1.6548	0.0429	0.6925	0.3348	P-value
TFF1	0.370	-1.4131	0.0290	-0.8135	0.1091	P-value
NAT1	0.534	-1.1769	0.0566	-0.8676	0.0286	P-value
BCL11A	0.792	1.4301	0.0226	0.5025	0.3410	P-value
ESR1	0.433	-1.1826	0.1389	-0.6544	0.3271	Non-Sig for Cluster
FOXC1	0.971	1.0662	0.0907	0.7204	0.1167	Non-Sig for Cluster
CA12	0.619	-1.1492	0.0754	-0.6528	0.1819	Non-Sig for Cluster
TFF3	0.323	-1.2150	0.0306	-1.2574	0.0072	
SCUBE2	0.236	-1.7797	0.0057	-1.7412	0.0002	
SFRP1	0.863	0.3691	0.6504	-0.5664	0.2513	Non-Sig for Cluster
ERBB4	0.062	-1.3026	0.0396	-1.4014	0.0060	
SIDT1	0.151	-0.5916	0.2867	-0.6315	0.1497	Non-Sig for Cluster
PSAT1	0.951	1.8187	0.0012	1.0046	0.0718	P-value
CHI3L1	0.932	1.3478	0.0468	1.7514	0.0002	
AR	0.466	-1.4545	0.0128	-1.7653	0.0002	
CD36	0.387	-1.2826	0.1282	-1.7183	0.0073	P-value
OGN	0.130	-1.9610	0.0052	-2.7564	<0.0001	
ABCA8	0.076	-1.1971	0.0828	-2.2152	0.0004	P-value
CFD	0.672	-0.9829	0.1432	-1.4696	0.0043	P-value
IGF1	0.400	-1.5276	0.0333	-2.0604	0.0005	
HBB	0.513	-0.9783	0.1093	-0.9881	0.0857	Non-Sig for Cluster
CDH1	0.983	-0.1380	0.8653	-0.0672	0.8899	Non-Sig for Cluster
MEOX2	0.087	-0.5799	0.2600	-1.4745	0.0011	P-value
GPX3	0.726	-0.9771	0.1205	-0.9916	0.0381	P-value
SCARA5	0.042	-0.6925	0.1893	-1.2819	0.0053	P-value
PDK4	0.665	-1.5644	0.0053	-1.7244	0.0033	
ENPP2	0.729	0.0241	0.9779	-0.9461	0.0532	Non-Sig for Cluster
AGTR1	0.079	-1.7157	0.0035	-1.8319	0.0002	
LEP	0.228	-0.8921	0.1269	-0.7419	0.0493	P-value
LPL	0.522	-1.0252	0.1342	-1.0940	0.0308	P-value
DPT	0.680	-0.7733	0.1964	-1.5068	0.0038	P-value
TIMP4	0.237	-0.7103	0.1969	-0.7563	0.0294	P-value
FHL1	0.897	-1.3389	0.0074	-2.0311	<0.0001	
SRPX	0.707	-1.0503	0.0106	-1.3525	0.0005	
EDNRB	0.122	-0.8647	0.0837	-1.1762	0.0032	P-value
SERPINB5	0.818	1.0485	0.1645	0.2695	0.6863	Non-Sig for Cluster
SOX10	0.543	-0.3852	0.5891	-0.2562	0.6674	Non-Sig for Cluster
IRX1	0.583	-0.6672	0.3000	-0.8272	0.0708	Non-Sig for Cluster
MIA	0.655	-9.00E-04	0.9991	-0.3929	0.3082	Non-Sig for Cluster
DSC2	0.777	0.6179	0.2135	0.4302	0.3089	Non-Sig for Cluster
TTYH1	0.214	-0.3259	0.5686	-0.6325	0.1130	Non-Sig for Cluster
COL9A3	0.499	-0.5192	0.2934	-0.5282	0.1918	Non-Sig for Cluster
FGL2	0.783	0.8663	0.0419	-0.2947	0.5540	P-value
RARRES3	0.780	0.6137	0.1250	0.5345	0.1538	Non-Sig for Cluster
PDE9A	0.450	-0.1441	0.7657	0.0415	0.9044	Non-Sig for Cluster
BST2	0.920	0.6706	0.0600	0.9216	0.0015	P-value
PTGER4	0.847	0.5601	0.1415	-0.4348	0.2541	Non-Sig for Cluster
KCNK5	0.681	0.3682	0.3537	0.1720	0.6078	Non-Sig for Cluster
PSMB9	0.984	1.5215	<0.0001	1.1239	0.0004	
HLA-DMA	0.946	0.8286	0.0102	0.6695	0.0625	P-value
EPHB3	0.527	-0.2218	0.5298	-0.2292	0.4506	Non-Sig for Cluster
IGSF6	0.691	0.9165	0.0029	0.0757	0.8688	P-value
ST3GAL6	0.340	0.0068	0.9902	-0.2879	0.3877	Non-Sig for Cluster
RHOH	0.532	0.2034	0.5839	-0.0684	0.8459	Non-Sig for Cluster
SGPP1	0.639	0.2704	0.3860	-0.0674	0.8229	Non-Sig for Cluster
CXCL9	0.992	2.5332	<0.0001	0.5584	0.3443	P-value
CXCL11	0.739	2.5289	<0.0001	1.4438	0.0069	
GBP5	0.787	2.2368	<0.0001	1.2960	0.0005	
GZMB	0.734	2.1797	<0.0001	1.4678	0.0010	

Table S14. 80 Gene Signature for NMF Cluster 4 (BLIA).

Gene	Discovery			Validation		Disagreement
	Centroid	log2(FC)	BH p	log2(FC)	BH p	
LAMP3	0.925	2.1252	<0.0001	1.6971	0.0002	
GBP1	0.982	2.0741	<0.0001	0.9435	0.0151	
ADAMDEC1	0.702	1.9019	<0.0001	0.9997	0.0436	
CCL5	0.851	1.7256	<0.0001	1.5863	0.0007	
SPON1	0.478	-1.7160	<0.0001	-1.7965	<0.0001	
PBK	0.799	1.6955	<0.0001	0.8303	0.0278	
STAT1	0.938	1.6940	<0.0001	0.4855	0.0931	P-value
EZH2	0.901	1.6612	<0.0001	1.1933	0.0004	
PLAT	0.467	-1.6445	<0.0001	-1.5013	0.0002	
TAP2	0.933	1.5587	<0.0001	1.1015	0.0001	
SLAMF7	0.766	1.5586	<0.0001	0.5750	0.1373	P-value
HERC5	0.882	1.5507	<0.0001	0.7186	0.0168	
SPOCK1	0.530	-1.5462	<0.0001	-1.5708	<0.0001	
TAP1	0.964	1.4987	<0.0001	1.1325	<0.0001	
CD2	0.901	1.4740	<0.0001	0.5667	0.1540	P-value
AIM2	0.684	1.4472	<0.0001	1.5442	<0.0001	

Table S16. Assignment of Validation Set Clusters by Discovery Set Centroids and Comparison to Validation Set NMF.

Sample	Cluster 1 (LAR)		Cluster 2 (MES)		Cluster 3 (BLIS)		Cluster 4 (BLIA)		NMF Cluster	Assigned Subtype
	Distance	p-value	Distance	p-value	Distance	p-value	Distance	p-value		
95675B1	0.044	4.94E-01	0.032	0.00E+00	0.026	0.00E+00	0.023	0.00E+00	4	4
99657A1	0.040	5.16E-02	0.036	6.00E-03	0.023	0.00E+00	0.018	0.00E+00	4	4
99848A1	0.043	1.10E-01	0.040	2.27E-02	0.032	0.00E+00	0.020	0.00E+00	4	4
99981A1	0.044	4.63E-02	0.042	3.19E-02	0.039	5.00E-04	0.024	0.00E+00	4	4
99988A1	0.044	1.16E-01	0.043	6.11E-02	0.030	0.00E+00	0.022	0.00E+00	4	4
70556A1	0.038	1.00E-03	0.039	1.60E-03	0.029	0.00E+00	0.028	0.00E+00	4	4
95247A1	0.042	1.42E-01	0.032	0.00E+00	0.027	0.00E+00	0.015	0.00E+00	4	4
94401B1	0.041	1.27E-02	0.043	6.84E-02	0.029	0.00E+00	0.032	0.00E+00	4	3
98857A2	0.044	2.60E-01	0.034	5.00E-04	0.025	0.00E+00	0.015	0.00E+00	4	4
99800A1	0.046	4.56E-01	0.040	6.10E-02	0.025	0.00E+00	0.018	0.00E+00	4	4
99884A1	0.043	3.83E-02	0.042	8.40E-03	0.042	2.32E-02	0.033	0.00E+00	4	4
100613A1	0.038	2.50E-03	0.036	4.00E-04	0.031	0.00E+00	0.025	0.00E+00	4	4
104600A1	0.044	2.08E-01	0.038	7.20E-03	0.029	0.00E+00	0.015	0.00E+00	4	4
105054A1	0.036	3.10E-03	0.037	1.37E-02	0.032	0.00E+00	0.022	0.00E+00	4	4
100893B1	0.044	2.14E-01	0.038	4.90E-03	0.027	0.00E+00	0.014	0.00E+00	4	4
105031A1	0.047	5.87E-01	0.042	4.08E-02	0.021	0.00E+00	0.020	0.00E+00	4	4
110310A1	0.046	6.49E-01	0.039	1.93E-02	0.021	0.00E+00	0.014	0.00E+00	4	4
111358A1	0.042	1.47E-01	0.032	1.00E-04	0.028	0.00E+00	0.023	0.00E+00	4	4
111970A1	0.038	5.60E-03	0.039	3.20E-03	0.027	0.00E+00	0.029	0.00E+00	4	3
112345A1	0.046	7.10E-01	0.039	3.66E-02	0.021	0.00E+00	0.020	0.00E+00	4	4
113063A1	0.045	3.89E-01	0.041	6.00E-02	0.026	0.00E+00	0.017	0.00E+00	4	4
114307A1	0.042	1.79E-01	0.034	5.00E-04	0.027	0.00E+00	0.022	0.00E+00	4	4
114505A1	0.042	3.32E-02	0.042	3.60E-02	0.034	0.00E+00	0.023	0.00E+00	4	4
114509A1	0.043	1.62E-01	0.040	5.00E-03	0.024	0.00E+00	0.023	0.00E+00	4	4
114826A1	0.046	3.65E-01	0.042	7.24E-02	0.024	0.00E+00	0.020	0.00E+00	4	4
115421A1	0.044	1.63E-01	0.043	1.04E-01	0.030	0.00E+00	0.021	0.00E+00	4	4
94224A1	0.043	2.34E-01	0.038	1.40E-03	0.028	0.00E+00	0.026	0.00E+00	4	4

Table S17. Description of Publically Available Data Sets, with IHC Data for ER/PR/HER2, Downloaded from Gene Omnibus Employed in 'External Set'.

Study	Acquisition and QC			PAM50 Intrinsic Subtype and Downstream ER Targets						PAM50
	# of TNBCs	Unique	Passed QC	Basal	Her2	LumA	LumB	Normal	ERSig	Fisher Test p
GSE7904	18	18	17	94%	0%	0%	0%	6%	0%	0.65
GSE18864	35	35	0	NA	NA	NA	NA	NA	NA	1.00
GSE18728	9	9	9	78%	0%	0%	0%	0%	11%	0.67
GSE19615	28	16	15	80%	7%	7%	7%	0%	13%	0.36
GSE21653	87	87	85	66%	18%	2%	1%	13%	7%	0.32
GSE26639	51	51	51	76%	4%	4%	4%	12%	12%	0.64
GSE2109	47	47	44	77%	9%	5%	5%	5%	9%	0.70
TOTAL	275	263	221	74%	10%	3%	3%	10%	9%	1.00

Table S18. Assignment of External Set Clusters by Discovery Set Centroids.

Sample	Source	Cluster 1 (LAR)		Cluster 2 (MES)		Cluster 3 (BLIS)		Cluster 4 (BLIA)		Assigned Subtype
		Distance	p-value	Distance	p-value	Distance	p-value	Distance	p-value	
GSM655834	GSE26639	0.047	7.89E-01	0.037	6.90E-03	0.019	0.00E+00	0.021	0.00E+00	3 (BLIS)
GSM655841	GSE26639	0.025	0.00E+00	0.035	6.40E-03	0.035	6.00E-03	0.033	2.00E-04	1 (LAR)
GSM655844	GSE26639	0.045	3.60E-01	0.038	3.83E-02	0.030	0.00E+00	0.023	0.00E+00	4 (BLIA)
GSM152698	GSE2109	0.042	5.06E-02	0.036	0.00E+00	0.034	0.00E+00	0.035	0.00E+00	3 (BLIS)
GSM152711	GSE2109	0.023	0.00E+00	0.030	1.00E-04	0.037	7.20E-02	0.038	1.09E-01	1 (LAR)
GSM152753	GSE2109	0.050	8.51E-01	0.044	1.13E-01	0.023	0.00E+00	0.029	0.00E+00	3 (BLIS)
GSM152766	GSE2109	0.023	0.00E+00	0.034	1.04E-02	0.039	2.25E-01	0.035	5.90E-03	1 (LAR)
GSM152768	GSE2109	0.041	3.09E-01	0.024	0.00E+00	0.034	0.00E+00	0.033	0.00E+00	2 (MES)
GSM179841	GSE2109	0.048	9.08E-01	0.040	6.37E-02	0.023	0.00E+00	0.021	0.00E+00	4 (BLIA)
GSM179854	GSE2109	0.040	5.65E-02	0.031	0.00E+00	0.029	0.00E+00	0.021	0.00E+00	4 (BLIA)
GSM46862	GSE2109	0.041	2.23E-01	0.028	0.00E+00	0.026	0.00E+00	0.022	0.00E+00	4 (BLIA)
GSM46874	GSE2109	0.033	2.00E-04	0.037	4.55E-02	0.038	2.22E-02	0.028	0.00E+00	4 (BLIA)
GSM46880	GSE2109	0.023	0.00E+00	0.036	2.19E-02	0.044	6.75E-01	0.040	1.28E-01	1 (LAR)
GSM46891	GSE2109	0.041	3.99E-01	0.028	0.00E+00	0.028	0.00E+00	0.025	0.00E+00	4 (BLIA)
GSM46968	GSE2109	0.046	5.38E-01	0.040	2.26E-02	0.031	0.00E+00	0.017	0.00E+00	4 (BLIA)
GSM46974	GSE2109	0.048	7.94E-01	0.037	4.20E-03	0.018	0.00E+00	0.020	0.00E+00	3 (BLIS)
GSM53032	GSE2109	0.043	4.69E-01	0.022	0.00E+00	0.034	0.00E+00	0.033	0.00E+00	2 (MES)
GSM53115	GSE2109	0.051	8.85E-01	0.044	4.41E-02	0.029	0.00E+00	0.031	0.00E+00	3 (BLIS)
GSM76492	GSE2109	0.023	0.00E+00	0.031	1.00E-04	0.044	4.98E-01	0.045	6.37E-01	1 (LAR)
GSM89003	GSE2109	0.047	9.26E-01	0.033	8.00E-04	0.024	0.00E+00	0.024	0.00E+00	3 (BLIS)
GSM89006	GSE2109	0.037	1.05E-02	0.030	0.00E+00	0.031	0.00E+00	0.036	7.00E-03	2 (MES)
GSM89008	GSE2109	0.049	7.59E-01	0.042	8.68E-02	0.031	0.00E+00	0.023	0.00E+00	4 (BLIA)
GSM89011	GSE2109	0.047	7.70E-01	0.036	1.60E-03	0.023	0.00E+00	0.022	0.00E+00	4 (BLIA)
GSM89016	GSE2109	0.047	7.32E-01	0.039	3.60E-03	0.026	0.00E+00	0.036	2.00E-04	3 (BLIS)
GSM89023	GSE2109	0.037	3.40E-03	0.040	4.64E-02	0.036	2.80E-03	0.031	0.00E+00	4 (BLIA)
GSM102525	GSE2109	0.044	2.32E-01	0.035	2.00E-04	0.024	0.00E+00	0.028	0.00E+00	3 (BLIS)
GSM102564	GSE2109	0.045	6.05E-01	0.024	0.00E+00	0.029	0.00E+00	0.035	7.00E-04	2 (MES)
GSM102573	GSE2109	0.040	1.57E-01	0.032	5.00E-04	0.024	0.00E+00	0.022	0.00E+00	4 (BLIA)
GSM117581	GSE2109	0.051	9.25E-01	0.046	3.23E-01	0.029	0.00E+00	0.025	0.00E+00	4 (BLIA)
GSM117730	GSE2109	0.045	3.73E-01	0.037	1.50E-03	0.031	0.00E+00	0.021	0.00E+00	4 (BLIA)
GSM117745	GSE2109	0.047	7.61E-01	0.040	1.07E-02	0.023	0.00E+00	0.032	0.00E+00	3 (BLIS)
GSM117761	GSE2109	0.041	2.17E-01	0.025	0.00E+00	0.032	0.00E+00	0.034	1.00E-04	2 (MES)
GSM137936	GSE2109	0.048	9.07E-01	0.037	5.60E-03	0.027	0.00E+00	0.026	0.00E+00	4 (BLIA)
GSM137989	GSE2109	0.048	6.88E-01	0.040	2.41E-02	0.029	0.00E+00	0.019	0.00E+00	4 (BLIA)
GSM152627	GSE2109	0.046	4.98E-01	0.040	3.09E-02	0.035	1.00E-04	0.022	0.00E+00	4 (BLIA)
GSM179885	GSE2109	0.044	6.34E-01	0.029	0.00E+00	0.027	0.00E+00	0.026	0.00E+00	4 (BLIA)
GSM179898	GSE2109	0.037	3.20E-03	0.022	0.00E+00	0.040	2.67E-02	0.039	3.55E-02	2 (MES)
GSM179902	GSE2109	0.046	7.71E-01	0.041	4.78E-02	0.025	0.00E+00	0.023	0.00E+00	4 (BLIA)
GSM179919	GSE2109	0.044	4.83E-01	0.029	0.00E+00	0.036	6.00E-04	0.028	0.00E+00	4 (BLIA)
GSM231886	GSE2109	0.050	8.97E-01	0.042	1.33E-01	0.030	0.00E+00	0.022	0.00E+00	4 (BLIA)
GSM231887	GSE2109	0.041	3.03E-01	0.030	2.00E-04	0.027	0.00E+00	0.023	0.00E+00	4 (BLIA)
GSM231918	GSE2109	0.046	5.80E-01	0.035	7.00E-04	0.028	0.00E+00	0.025	0.00E+00	4 (BLIA)
GSM277681	GSE2109	0.041	5.50E-02	0.040	3.11E-02	0.032	0.00E+00	0.029	0.00E+00	4 (BLIA)
GSM301651	GSE2109	0.021	0.00E+00	0.040	1.66E-02	0.048	8.42E-01	0.051	9.53E-01	1 (LAR)
GSM301653	GSE2109	0.043	3.35E-01	0.035	2.90E-03	0.029	0.00E+00	0.018	0.00E+00	4 (BLIA)
GSM301664	GSE2109	0.028	0.00E+00	0.036	4.94E-02	0.039	5.91E-02	0.030	0.00E+00	1 (LAR)
GSM325787	GSE2109	0.050	9.54E-01	0.042	3.72E-02	0.022	0.00E+00	0.035	0.00E+00	3 (BLIS)