



An in vitro model of differentiation of memory B cells into plasmablasts and plasma cells including detailed phenotypic and molecular characterization.

Michel Jourdan, Anouk Caraux, John de Vos, Geneviève Fiol, Marion Larroque, Chantal Cognot, Caroline Bret, Christophe Duperray, Dirk Hose, Bernard Klein

► To cite this version:

Michel Jourdan, Anouk Caraux, John de Vos, Geneviève Fiol, Marion Larroque, et al.. An in vitro model of differentiation of memory B cells into plasmablasts and plasma cells including detailed phenotypic and molecular characterization.. Blood, 2009, 114 (25), pp.5173-81. 10.1182/blood-2009-07-235960 . inserm-00446133

HAL Id: inserm-00446133

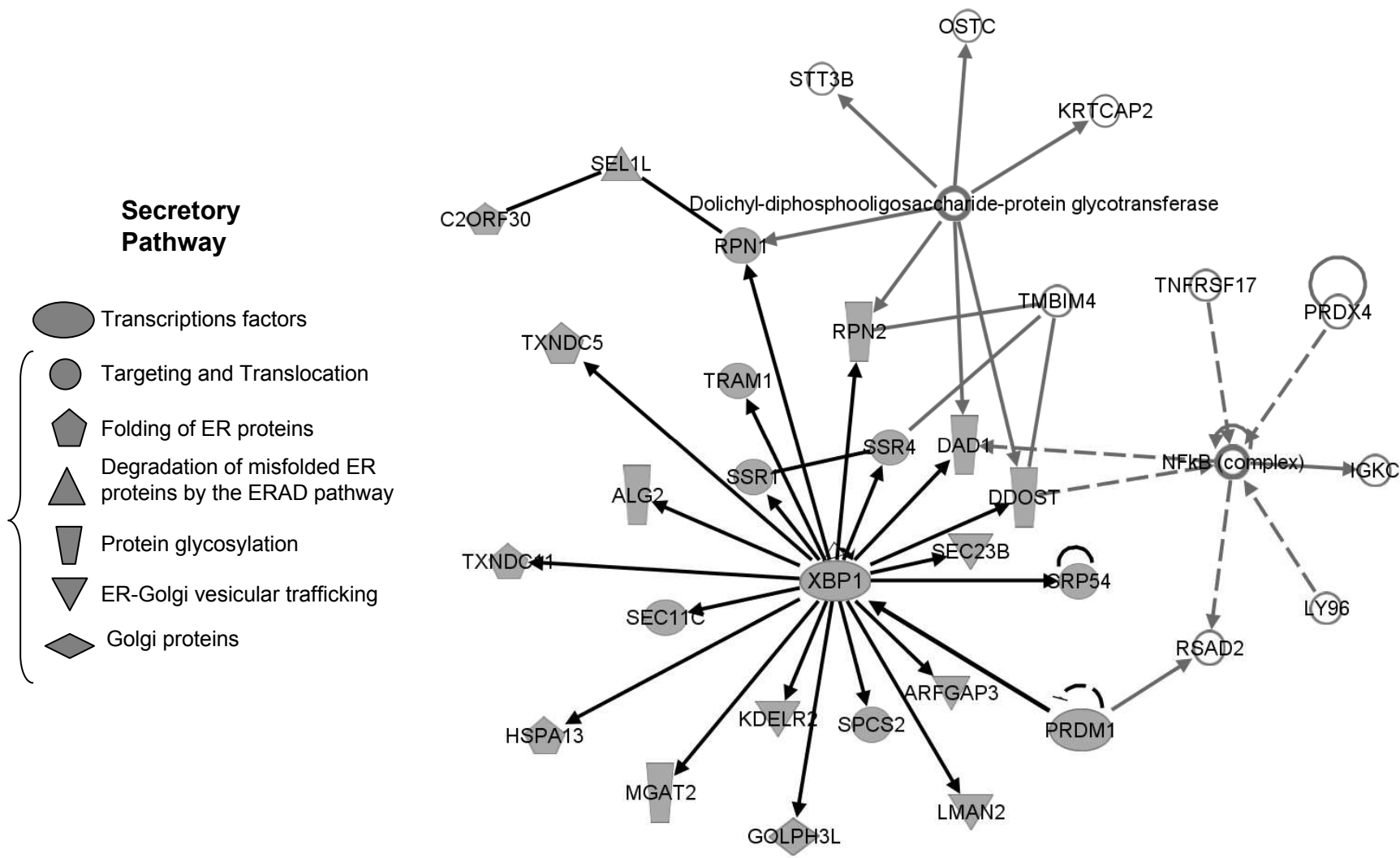
<https://inserm.hal.science/inserm-00446133>

Submitted on 25 Jan 2010

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Figure S1



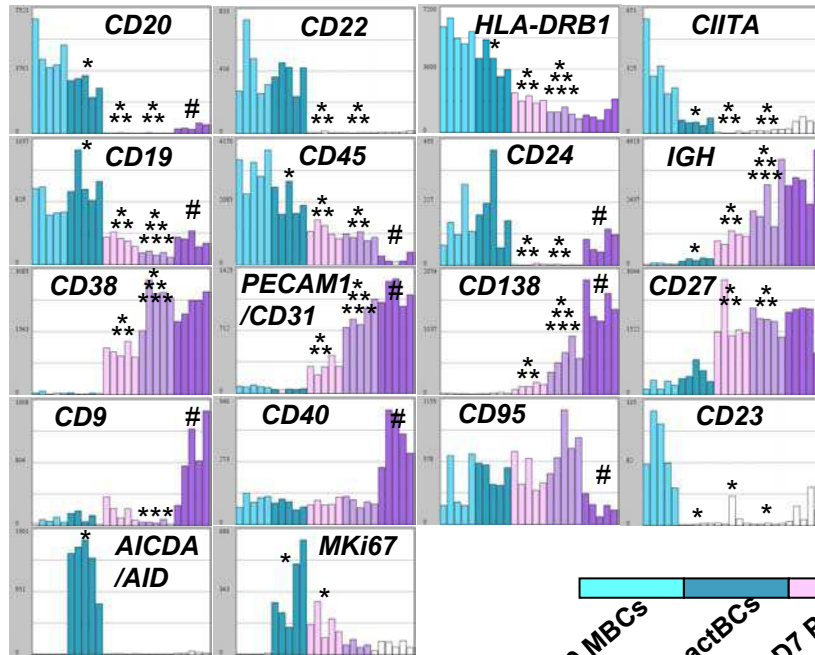
© 2000-2009 Ingenuity Systems, Inc. All rights reserved.

Figure S1. Biological plasma cell networks

Biological pathways encoded by the 202 unique plasma cell genes overexpressed in D7 PBs+D10 PCs+BMPCs compared to D0 MBCs+D4 actBCs were analyzed with Ingenuity software. Data are those of the highest score (67) network with 33 PC genes out of the 50 in the network. This network mainly comprises genes coding for proteins inducing *XBP1* expression or genes activated by *XBP1*. The networks are shown in supplemental Table 5.

Figure S2

A



B

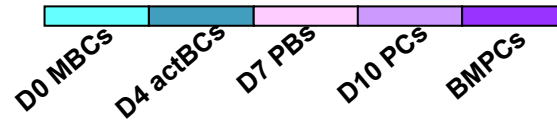
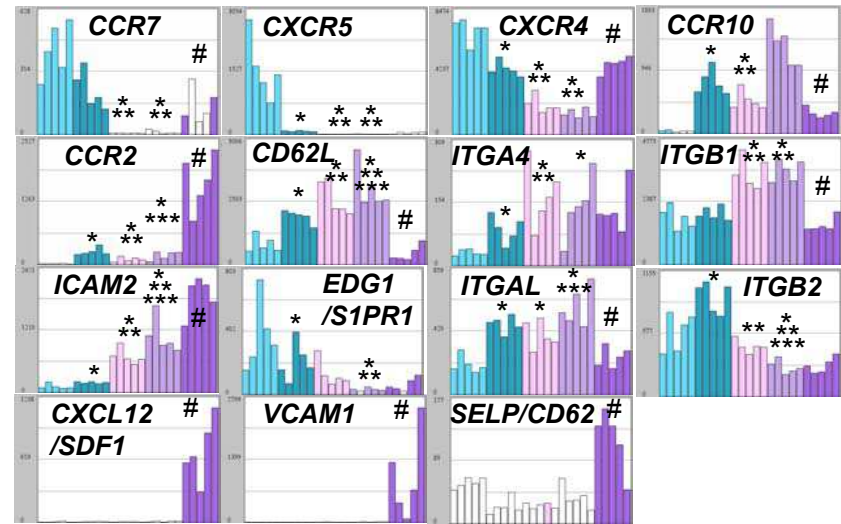
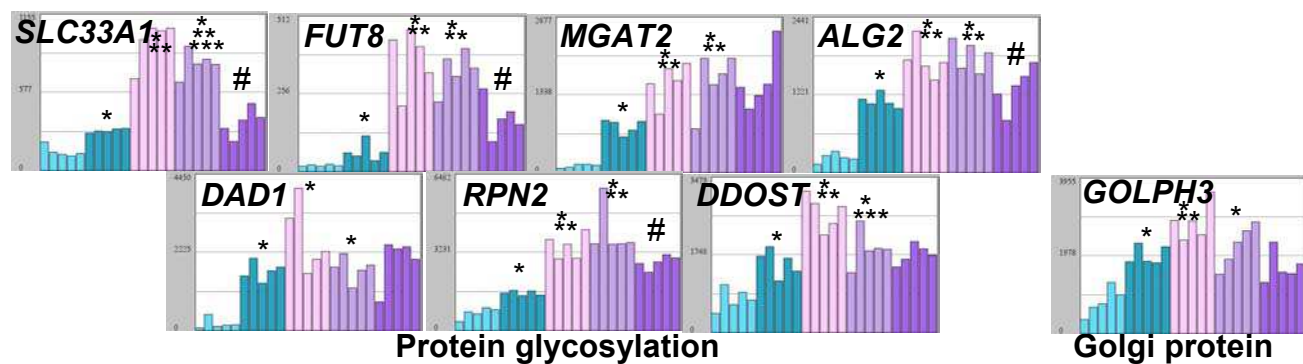
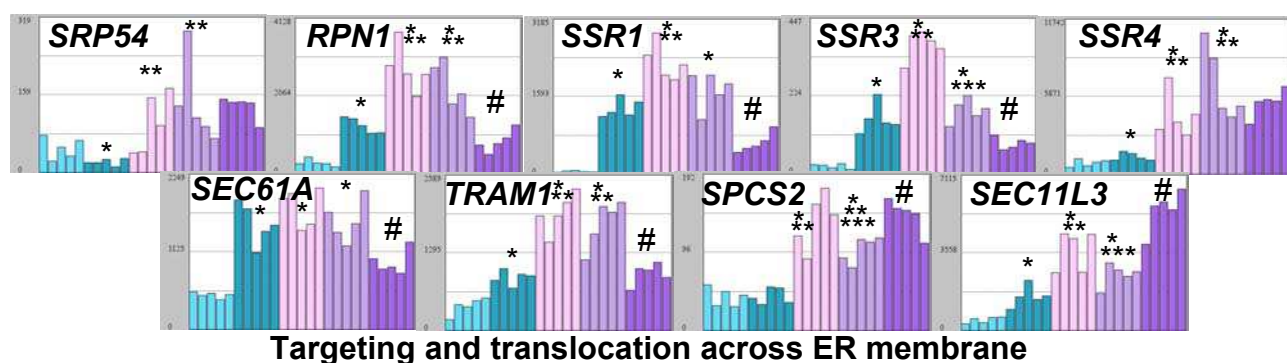
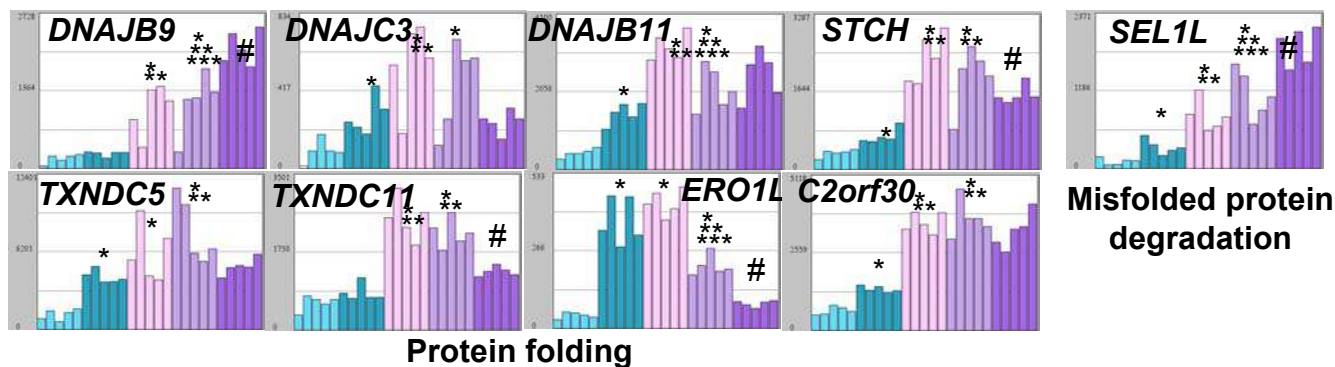
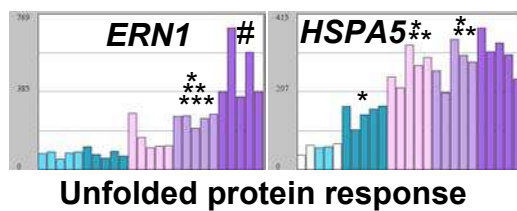


Figure S2. Visualization of gene expression using Amazonia “B cell to plasma cell Atlas”.

Data are the expression of genes coding for main B and PC markers (A) and homing molecules (B). * indicates that the mean expression is different from that in D0 MBCs, ** from that in D4 actBCs, *** from that in D7 PBs and # between D10 PCs and BMPCs.

Figure S3



Activation	sCD40L + ODN	sCD40L	ODN	sCD40L	sCD40L
Cytokines	IL-2+IL-10 +IL-15	IL-2+IL-10+IL-15	IL-2+IL-10+IL-15	IL-2+IL-4	IL-2+IL-4+ IL-10+IL-12
Mean cell amplification	6.1 ± 1.8 n=19	3.3 ± 0.8* n=4	2.0 ± 0.5* n=10	0.8 ± 0.1 n=2	3.4 ± 1.2* n=6
Cell viability	94%	95%	87%	63%	93%
CD20 ⁺ CD38 ⁻ activated B cells (%)	42.3 ± 12.2 n=13	35.0 ± 5.9 n=4	37.7 ± 9.2 n=3	45.1 ± 12.6 n=2	23.1 ± 7.2 n=6
CD20 ⁺ CD38 ⁺ intermediate cells (%)	16.4 ± 12.5 n=13	18.3 ± 9.3 n=4	36.3 ± 8.6 n=3	47.2 ± 19.8 n=2	27.4 ± 11.9 n=6
CD20 ⁻ CD38 ⁺⁺ plasmablasts/plasma cells (%)	19.5 ± 5.5 n=13	22.8 ± 6.3 n=4	15.4 ± 3.7 n=3	6.3 ± 6.2 n=2	34.6 ± 6.6 n=6
CD20 ⁻ CD38 ⁺ CD138 ⁺ plasma cells (%)	2.1 ± 0.9 n=13	2.2 ± 1.0 n=4	2.2 ± 0.7 n=3	4.3 ± 0.5 n=2	4.4 ± 2.0 n=6

Table S1: B cell amplification and differentiation. Day 0-4. Step 1.

Purified memory B cells were cultured for 4 days using either sCD40L and/or ODN activation and various cytokine cocktails. At day 4, cell counts and viability were determined and cell phenotype was assayed with fluorochrome-conjugated anti-CD20, CD38, or CD138 mAb, or isotype-matched control mAb. Flow cytometry was performed with a FACScan device. Results are shown as the mean ± SD of n experiments. * indicates that the data are significantly different from those obtained in the sCD40L+ODN+IL-2+IL-10+IL-15 group ($P \leq .008$).

Step 1	sCD40L + ODN + IL-2+IL-10+IL-15	ODN + IL-2+IL-10+IL-15	sCD40L+ IL-2+IL-10+IL-15
Step 2 Culture conditions	IL-2 +IL-6+IL-10 +IL-15	IL-2+IL-6+IL-10 +IL-15	IL-2+IL-6 +IL-10+IL-12
Mean cell amplification in step2	3.7 ± 1.3 n=18	1.6 ± 0.6 n=9*	2.5 ± 0.7 n=6*
Cell viability	81%	79%	72%
Activated B cells CD20 ⁺ CD38 ⁻ (%)	11.7± 5.1 n=13	13.7 ± 7.2 n=4	1.5 ± 1.8 n=6
Intermediate cells CD20 ⁺ CD38 ⁺ (%)	20.1 ± 8.8 n=13	37.2 ± 10.9 n=4	13.5 ± 10.8 n=6
Plasmablasts / plasma cells CD20 ⁻ CD38 ⁺⁺ (%)	56.6 ± 7.7 n=13	41.6 ± 3.4 n=4	81.1 ± 9.5 n=6
Plasma cells CD138 ⁺ CD20 ⁻ CD38 ⁺⁺ (%)	15.9 ± 6;2 n=13	24.0 ± 12.4 n=4	30.1 ± 11.0 n=6
Yield of plasmablast/plasma cell generation for one starting memory B cells	12.3 ± 6.1 n=13	1.6 ± 0.8 n=4	6.2 ± 2.8 n=6

Table S2: Plasmablastic differentiation. Days 4-7. Step 2.

Purified memory B cells were cultured for 4 days in the various culture conditions as described in supplemental Table 1 and further cultured for 3 days with various cytokine combinations as indicated. At day 3 (day 7 of the whole culture), cell counts and viability were determined and the cell phenotype was assayed with fluorochrome-conjugated anti-CD20, CD38, or CD138 mAb, or isotype-matched control mAb. Flow cytometry was performed with a FACScan device. Results are shown as the mean ± SD of n experiments. * Indicates that the data are significantly different ($P \leq .04$) from those obtained in the sCD40L+ODN+IL-2+IL-6+IL-10+IL-15 group.

Step 1	sCD40L + ODN +IL-2+IL-10+IL-15	ODN +IL-2+IL-10+IL-15	sCD40L +IL-2+IL-10+IL-15
Step 3			
Culture conditions	IL-6+IL-15+IFN- α	IL-6+IL-15+IFN- α	IL-6+IL-15+IFN- α
Mean cell amplification in step 3	0.51 $\pm$ 0.09 n=17	0.52 $\pm$ 0.14 n=8	0.33 $\pm$ 0.13 n=4
Cell viability	38%	43%	24%
Activated B cells CD20 ⁺ CD38 ⁻ (%)	2.2 $\pm$ 1.2 n=13	2.7 $\pm$ 0.7 n=5	1.2 $\pm$ 0.8 n=4
Intermediate cells CD20 ⁺ CD38 ⁺ (%)	13.6 $\pm$ 8.5 n=13	25.3 $\pm$ 3.0 n=5	8.4 $\pm$ 2.8 n=4
Plasmablasts / Plasma cells CD20 ⁻ CD38 ⁺⁺ (%)	79.0 $\pm$ 8.8 n=13	68.2 $\pm$ 3.5 n=5	86.3 $\pm$ 4.5 n=4
Plasma cells CD138 ⁺ CD20 ⁻ CD38 ⁺⁺ (%)	54.8 $\pm$ 8.7 n=13	49.4 $\pm$ 5.0 n=5	65.0 $\pm$ 11.2 n=4
Yield of mature plasma cell generation for one starting B cells	6.3 $\pm$ 3.3 n=13	0.86 $\pm$ 0.45 n=7	2.4 $\pm$ 1.3 n=3

Table S3: Plasma cell differentiation. Day 7-10. Step 3.

Purified memory B cells were cultured for 4 days in the various culture conditions as described in supplemental Table 1 and then for 3 days as described in supplemental Table 2. At day 7, cells were cultured with IL-6+IL-15+IFN- α for 3 days and cell count and viability were determined. The cell phenotype was assayed with fluorochrome-conjugated anti-CD20, CD38, or CD138 mAb, or isotype-matched control mAb. Flow cytometry was performed with a FACScan device. Results are shown as the mean $\pm$ SD of n experiments.

Table S4. B cell and plasma cell genes.

B cell genes (257)				Plasma cell genes (202)			
Gene ID	Gene Name	Fold Change	Score(d)	Gene ID	Gene Name	Fold Change	Score(d)
206126_at	BLR1	0.02	-2.08	203153_at	IFIT1	196.72	2.08
228592_at	MS4A1	0.04	-2.08	201656_at	ITGA6	176.21	2.08
207339_s_at	LTB	0.04	-2.08	205569_at	LAMP3	100.81	2.00
204440_at	CD83	0.05	-1.94	206121_at	AMPD1	99.61	1.86
209118_s_at	TUBA3	0.05	-2.08	203868_s_at	VCAM1	91.25	1.50
1554036_at	ZBTB24	0.07	-1.30	205692_s_at	CD38	66.37	2.08
210982_s_at	HLA-DRA	0.07	-2.08	201287_s_at	SDC1	52.81	2.08
214097_at	RPS21	0.07	-2.08	213797_at	RSAD2	46.56	1.78
214369_s_at	RASGRP2	0.08	-1.53	212097_at	CAV1	31.27	2.08
203932_at	HLA-DMB	0.08	-1.94	226702_at	LOC129607	30.88	1.32
213758_at	COX4I1	0.08	-1.72	228486_at	SLC44A1	25.70	2.08
200934_at	DEK	0.09	-2.08	204415_at	G1P3	24.14	1.69
218032_at	SNN	0.10	-1.39	219159_s_at	SLAMF7	22.11	2.08
217234_s_at	VIL2	0.10	-2.02	214768_x_at	IGKV1-5	18.99	2.08
206255_at	BLK	0.10	-1.89	203675_at	NUCB2	17.05	2.08
209795_at	CD69	0.10	-1.72	205483_s_at	G1P2	15.86	1.44
224838_at	FOXP1	0.10	-2.08	214152_at	CCPG1	15.63	2.08
221059_s_at	COTL1	0.10	-2.08	214973_x_at	IGHD	15.37	2.08
204057_at	IRF8	0.11	-2.08	202688_at	TNFSF10	14.66	2.02
207957_s_at	PRKCB1	0.11	-2.08	216557_x_at	IGHA1 /// IGHG1	13.25	2.08
203879_at	PIK3CD	0.11	-2.08	219551_at	EAF2	11.82	2.08
212543_at	AIM1	0.11	-2.08	225032_at	FNDC3B	11.63	2.08
222624_s_at	ZNF639	0.12	-1.86	200983_x_at	CD59	11.29	2.08
219667_s_at	BANK1	0.12	-2.08	216542_x_at	IGHG1 /// MGC2	10.69	2.08
218329_at	PRDM4	0.13	-1.80	396_f_at	EPOR	10.37	2.08
211656_x_at	HLA-DQB1	0.13	-2.08	205352_at	SERPINI1	9.30	1.89
219681_s_at	RAB11FIP1	0.13	-2.05	224404_s_at	FCRL5	8.91	2.08
203320_at	LNK	0.13	-1.50	219505_at	CECR1	8.90	2.08
206571_s_at	MAP4K4	0.14	-2.08	202086_at	MX1	8.90	1.44
217957_at	GTL3	0.14	-2.08	213620_s_at	ICAM2	8.18	2.08
213142_x_at	LOC54103	0.15	-1.30	201923_at	PRDX4	7.67	2.08
201137_s_at	HLA-DPB1	0.15	-2.05	228167_at	KLHL6	7.35	2.08
202693_s_at	STK17A	0.15	-2.08	205552_s_at	OAS1	7.21	1.91
217992_s_at	EFHD2	0.16	-2.05	222805_at	MANEA	7.16	2.08
224681_at	GNA12	0.17	-2.08	208436_s_at	IRF7	7.15	2.08
204286_s_at	PMAIP1	0.17	-1.72	209417_s_at	IFI35	6.85	1.78
218611_at	IER5	0.17	-1.75	200670_at	XBP1	6.77	2.08
223028_s_at	SNX9	0.17	-2.00	219118_at	FKBP11	6.68	2.08
202107_s_at	MCM2	0.17	-1.72	200887_s_at	STAT1	6.66	1.94
203927_at	NFKBIE	0.17	-1.16	208982_at	PECAM1	6.33	2.08
34210_at	CD52	0.17	-2.00	226452_at	PDK1	6.14	2.08
213111_at	PIP5K3	0.18	-2.02	206584_at	LY96	5.86	2.08
200634_at	PFN1	0.18	-1.64	217148_x_at	IGLV2-14	5.82	2.08
211962_s_at	ZFP36L1	0.18	-1.94	203041_s_at	LAMP2	5.82	2.08
203414_at	MMD	0.19	-2.08	202304_at	FNDC3A	5.79	2.08
202626_s_at	LYN	0.19	-2.08	216044_x_at	FAM69A	5.76	2.05
224718_at	YY1	0.19	-1.26	207734_at	LAX1	5.49	2.08
210110_x_at	HNRPH3	0.19	-2.08	204079_at	TPST2	5.31	2.08
202345_s_at	FABP5	0.20	-1.78	203066_at	GALNAC4S-6S1	5.30	2.08
209306_s_at	SWAP70	0.20	-2.08	201004_at	SSR4	5.18	2.08
216237_s_at	MCM5	0.21	-2.00	224983_at	SCARB2	5.17	2.08
224734_at	HMGB1	0.21	-2.02	204639_at	ADA	5.17	1.83
209312_x_at	HLA-DRB1	0.22	-2.08	200742_s_at	TPP1	5.00	2.08
225010_at	CCDC6	0.22	-2.08	210385_s_at	ARTS-1	4.98	1.61
212774_at	ZNF238	0.22	-1.80	204972_at	OAS2	4.95	1.33
235791_x_at	CHD1	0.23	-1.86	220146_at	TLR7	4.91	1.30
201930_at	MCM6	0.23	-1.55	223243_s_at	C1orf22	4.90	1.96
208795_s_at	MCM7	0.23	-1.89	206150_at	TNFRSF7	4.88	2.08
222740_at	ATAD2	0.23	-1.44	209457_at	DUSP5	4.71	2.08
226753_at	FAM76B	0.23	-2.08	212603_at	MRPS31	4.69	2.05
208821_at	SNRNPB	0.24	-2.05	201494_at	PRCP	4.62	2.08
217466_x_at	RPS2 /// LOC91:	0.24	-1.83	221286_s_at	PACAP	4.60	2.08
201925_s_at	DAF	0.24	-1.61	228964_at	PRDM1	4.55	2.08
209083_at	CORO1A	0.24	-2.08	221004_s_at	ITM2C	4.50	2.08
208881_x_at	IDI1	0.24	-2.08	203028_s_at	CYBA	4.43	1.91
209728_at	HLA-DRB4	0.24	-1.47	207761_s_at	DKFZP586A052	4.41	2.08

211991_s_at	HLA-DPA1	0.25	-2.08	222620_s_at	DNAJC1	4.29	2.08
212288_at	FNBP1	0.25	-2.08	202061_s_at	SEL1L	4.28	2.08
208313_s_at	SF1	0.25	-2.08	212900_at	SEC24A	4.25	2.08
201751_at	KIAA0063	0.25	-1.97	206641_at	TNFRSF17	4.19	2.05
209688_s_at	FLJ10996	0.25	-1.61	218254_s_at	SAR1B	4.14	2.08
202499_s_at	SLC2A3	0.26	-1.91	212334_at	GNS	4.08	1.97
208549_x_at	PTMA /// LOC44	0.26	-2.02	202901_x_at	CTSS	4.05	1.97
202880_s_at	PSCD1	0.26	-2.08	212195_at	IL6ST	4.01	2.02
208306_x_at	HLA-DRB5	0.26	-2.08	225636_at	STAT2	3.99	1.91
201721_s_at	LAPTM5	0.27	-2.08	204785_x_at	IFNAR2	3.98	2.08
201594_s_at	PPP4R1	0.27	-2.08	204698_at	ISG20	3.97	2.02
212827_at	IGHM	0.27	-2.08	200643_at	HDLBP	3.92	1.94
212928_at	TSPYL4	0.27	-1.82	200620_at	TMEM59	3.91	2.08
226215_s_at	FBXL10	0.27	-2.08	226422_at	PTX1	3.88	2.08
204882_at	ARHGAP25	0.27	-1.30	227087_at	INPP4A	3.88	2.08
211921_x_at	PTMA	0.28	-2.08	200803_s_at	TEGT	3.86	2.08
224833_at	ETS1	0.28	-2.08	223299_at	SEC11L3	3.84	2.05
224783_at	MGC29814	0.28	-2.02	200805_at	LMAN2	3.82	1.91
210448_s_at	P2RX5	0.28	-1.72	219209_at	IFIH1	3.82	1.30
214805_at	EIF4A1	0.28	-1.29	202558_s_at	STCH	3.76	2.05
200010_at	RPL11	0.28	-1.75	223209_s_at	SELS	3.75	2.08
222669_s_at	SBDS	0.28	-1.39	221530_s_at	BHLHB3	3.75	1.97
203538_at	CAMLG	0.29	-2.08	225706_at	GLCCI1	3.70	2.00
201197_at	AMD1	0.29	-2.08	213836_s_at	WIPI49	3.67	2.08
212587_s_at	PTPRC	0.29	-2.08	204820_s_at	BTN3A3 /// BTN	3.67	2.08
205967_at	HIST1H4C	0.29	-1.47	200663_at	CD63	3.64	2.05
200904_at	HLA-E	0.29	-1.16	212345_s_at	CREB3L2	3.62	2.08
201909_at	RPS4Y1	0.29	-2.02	200698_at	KDELRL2	3.61	2.05
213864_s_at	NAP1L1	0.29	-2.08	201858_s_at	PRG1	3.58	1.94
226633_at	RAB8B	0.30	-2.08	208943_s_at	TLOC1	3.58	2.08
218100_s_at	ESRRBL1	0.30	-1.12	202842_s_at	DNAJB9	3.57	2.08
202900_s_at	NUP88	0.30	-2.08	200701_at	NPC2	3.50	2.08
225310_at	RBMX	0.31	-2.08	224628_at	C2orf30	3.47	2.08
224654_at	DDX21 /// ZNF51	0.31	-2.08	201649_at	UBE2L6	3.47	1.62
1557820_at	AFG3L2	0.31	-2.00	203102_s_at	MGAT2	3.45	2.00
209422_at	PHF20	0.31	-1.33	208959_s_at	TXNDC4	3.39	2.08
224986_s_at	PDPK1	0.31	-2.08	221739_at	C19orf10	3.39	2.08
204197_s_at	RUNX3	0.32	-1.94	222753_s_at	SPCS3	3.38	2.08
203175_at	RHOG	0.32	-1.98	224759_s_at	MGC17943	3.37	2.00
221726_at	RPL22	0.32	-2.08	218048_at	COMMD3	3.37	2.08
225213_at	TA-PP2C	0.32	-1.97	208658_at	PDIA4	3.35	2.05
206052_s_at	SLBP	0.32	-2.08	218007_s_at	RPS27L	3.27	2.02
206095_s_at	FUSIP1	0.32	-2.08	209014_at	MAGED1	3.24	2.00
212036_s_at	PNN	0.33	-2.08	218018_at	PD XK	3.22	1.30
218640_s_at	PLEKHF2	0.33	-1.41	222411_s_at	SSR3	3.21	2.02
214339_s_at	MAP4K1	0.33	-2.08	225512_at	ZBTB38	3.20	2.08
201231_s_at	ENO1	0.33	-1.22	221760_at	MAN1A1	3.20	1.91
234339_s_at	GLTSCR2	0.33	-1.11	209806_at	HIST1H2BK	3.20	2.02
203185_at	RASSF2	0.33	-2.05	208872_s_at	C5orf18	3.20	2.08
225049_at	BLOC1S2	0.33	-2.08	202241_at	TRIB1	3.19	2.05
212671_s_at	HLA-DQA1 /// HI	0.33	-1.69	208653_s_at	CD164	3.17	1.58
218205_s_at	MKNK2	0.33	-1.86	1555889_a_a	CRTAP	3.15	2.08
220755_s_at	C6orf48	0.34	-2.08	212311_at	KIAA0746	3.11	2.02
204009_s_at	KRAS	0.34	-2.08	214257_s_at	SEC22L1	3.11	2.08
208885_at	LCP1	0.34	-1.33	208689_s_at	RPN2	3.06	2.08
219762_s_at	RPL36	0.34	-1.75	210046_s_at	IDH2	3.04	2.00
208627_s_at	YBX1	0.34	-1.94	226683_at	SNAG1	3.02	1.72
201101_s_at	BCLAF1	0.34	-1.36	217732_s_at	ITM2B	3.02	2.08
201861_s_at	LRRFIP1	0.34	-2.08	218361_at	GOLPH3L	3.01	1.47
212330_at	TFDP1	0.34	-1.19	217855_x_at	SDF4	3.01	2.08
201917_s_at	SLC25A36	0.34	-1.59	212737_at	GM2A	3.00	1.89
214280_x_at	HNRPA1	0.35	-2.05	224885_s_at	KRTCAP2	2.99	2.08
203057_s_at	PRDM2	0.35	-1.33	226860_at	TMEM19	2.98	1.39
217816_s_at	PCNP	0.35	-2.08	202027_at	C22orf5	2.95	1.62
208913_at	GGA2	0.36	-1.94	200703_at	DNCL1	2.94	1.89
200593_s_at	HNRPU	0.36	-2.05	202857_at	TMEM4	2.93	2.08
215785_s_at	CYFIP2	0.36	-2.00	204274_at	EBAG9	2.90	2.08
202413_s_at	USP1	0.36	-2.08	217788_s_at	GALNT2	2.88	1.41
201954_at	ARPC1B	0.36	-1.55	217933_s_at	LAP3	2.80	1.39

211986_at	AHNAK	0.36	-1.16	201236_s_at	BTG2	2.79	2.08
217947_at	CKLF5F6	0.36	-2.05	223325_at	TXNDC11	2.78	2.08
212401_s_at	CDC2L1 /// CDC	0.36	-1.47	214730_s_at	GLG1	2.77	1.78
224897_at	WDR26	0.36	-1.19	216032_s_at	C20orf47	2.77	1.83
212131_at	FAM61A	0.36	-1.78	227189_at	CPNE5	2.75	1.89
204951_at	RHOH	0.36	-1.30	203136_at	RABAC1	2.75	1.91
202573_at	CSNK1G2	0.37	-1.28	201944_at	HEXB	2.74	2.05
201330_at	RARS	0.37	-1.55	223054_at	DNAJB11	2.74	1.91
239377_at	MGC11102	0.37	-1.75	217824_at	UBE2J1	2.70	2.08
200692_s_at	HSPA9B	0.37	-2.08	200945_s_at	SEC31L1	2.68	2.08
201584_s_at	DDX39	0.38	-2.08	204805_s_at	H1FX	2.66	1.55
201170_s_at	BHLHB2	0.38	-1.41	217917_s_at	DNCL2A	2.63	2.02
203907_s_at	IQSEC1	0.38	-1.16	207157_s_at	GNG5	2.63	1.97
228204_at	PSMB4	0.38	-1.44	209340_at	UAP1	2.59	1.94
201725_at	C10orf7	0.38	-1.94	218189_s_at	NANS	2.58	1.94
208944_at	TGFBR2	0.38	-1.80	201889_at	FAM3C	2.57	2.02
200916_at	TAGLN2	0.38	-1.78	1555575_a_a	KDELRL1	2.56	1.91
212418_at	ELF1	0.38	-1.16	218213_s_at	C11orf10	2.55	1.91
208615_s_at	PTP4A2	0.38	-1.44	201011_at	RPN1	2.53	1.44
209898_x_at	ITSN2	0.38	-1.75	201384_s_at	NBR1	2.52	1.61
212646_at	RAFTLIN	0.38	-1.30	201098_at	COPB2	2.52	1.41
200748_s_at	FTH1	0.38	-1.83	201239_s_at	SPCS2	2.51	1.78
200892_s_at	SFRS10	0.39	-2.05	200616_s_at	KIAA0152	2.50	1.41
227932_at	ARIH2	0.39	-1.36	223892_s_at	TMBIM4	2.50	2.08
208630_at	HADHA	0.39	-1.69	217858_s_at	ARMCX3	2.49	2.08
224841_x_at	GAS5	0.39	-1.58	200929_at	TMED10	2.48	1.91
201112_s_at	CSE1L	0.39	-1.44	204159_at	CDKN2C	2.47	1.30
211623_s_at	FBL	0.39	-2.08	205901_at	PNOC	2.47	1.97
218668_s_at	RAP2C	0.39	-1.89	218203_at	ALG5	2.45	2.00
218738_s_at	RNF138	0.39	-1.91	218170_at	ISOC1	2.45	1.80
217478_s_at	HLA-DMA	0.39	-1.97	204205_at	APOBEC3G	2.44	1.97
207988_s_at	ARPC2	0.40	-2.02	201568_at	QP-C	2.43	1.55
202300_at	HBXIP	0.40	-1.91	202211_at	ARFGAP3	2.42	1.94
214812_s_at	MOBK1B	0.40	-2.08	201399_s_at	TRAM1	2.42	1.80
227110_at	HNRPC	0.40	-1.89	225621_at	ALG2	2.42	1.91
200750_s_at	RAN	0.41	-2.00	200969_at	SERP1	2.41	2.08
201606_s_at	PWP1	0.41	-2.08	200678_x_at	GRN	2.40	1.79
224810_s_at	ANKRD13	0.41	-1.66	209001_s_at	ANAPC13	2.38	2.08
213293_s_at	TRIM22	0.41	-1.30	224700_at	SIMP	2.36	1.94
201305_x_at	ANP32B	0.41	-1.97	221253_s_at	TXNDC5	2.35	1.83
224656_s_at	MTPN	0.41	-2.08	218320_s_at	NDUFB11	2.34	1.97
212721_at	SFRS12	0.41	-1.39	201690_s_at	TPD52	2.33	2.08
211968_s_at	HSPCA	0.41	-2.08	202084_s_at	SEC14L1	2.33	2.08
200064_at	HSPCB	0.42	-2.02	201832_s_at	VDP	2.32	1.64
212232_at	FNBP4	0.42	-1.19	209200_at	MEF2C	2.31	1.58
200911_s_at	TACC1	0.42	-2.00	206632_s_at	APOBEC3B	2.31	1.33
218088_s_at	RRAGC	0.42	-1.22	225433_at	GTF2A1	2.27	1.36
200715_x_at	RPL13A	0.42	-2.08	200046_at	DAD1	2.26	1.55
206245_s_at	IVNS1ABP	0.42	-1.55	202655_at	ARMET	2.24	1.61
224594_x_at	ACTB	0.42	-2.00	202502_at	ACADM	2.24	1.64
233936_s_at	ZNF403	0.42	-1.69	224891_at	FOXO3A	2.24	1.91
225136_at	PLEKHA2	0.42	-2.08	201900_s_at	AKR1A1	2.20	1.83
208956_x_at	DUT	0.43	-1.97	225327_at	FLJ10980	2.20	1.39
202864_s_at	SP100	0.43	-1.28	201762_s_at	PSME2	2.20	1.64
218499_at	MASK	0.43	-2.05	203613_s_at	NDUFB6	2.18	1.44
224964_s_at	GNG2	0.43	-1.75	201096_s_at	ARF4	2.13	1.66
214334_x_at	DAZAP2 /// LOC	0.43	-1.41	203605_at	SRP54	2.11	1.41
209780_at	PHTF2	0.43	-1.80	223001_at	DC2	2.11	1.80
227068_at	PGK1	0.43	-1.33	229419_at	FBXW7	2.10	2.02
202097_at	NUP153	0.43	-2.08	222763_s_at	WDR33	2.10	1.47
202302_s_at	FLJ11021	0.43	-1.72	202605_at	GUSB	2.09	2.02
222417_s_at	SNX5	0.43	-1.75	214150_x_at	ATP6V0E	2.08	1.69
213088_s_at	DNAJC9	0.44	-1.91	205812_s_at	TMED9	2.07	1.75
222976_s_at	TPM3	0.44	-2.08	210293_s_at	SEC23B	2.03	1.86
203137_at	WTAP	0.44	-1.16	221471_at	TDE1	2.03	1.33
212085_at	SLC25A6	0.44	-1.89	207812_s_at	GORASP2	2.03	2.00
212227_x_at	EIF1	0.44	-1.47	208674_x_at	DDOST	2.02	2.02
220890_s_at	DDX47	0.44	-1.89				
200686_s_at	SFRS11	0.44	-2.05				

209153_s_at	TCF3	0.44	-1.75
201225_s_at	SRRM1	0.44	-2.00
217846_at	QARS	0.44	-2.08
201892_s_at	IMPDH2	0.45	-1.64
223218_s_at	NFKBIZ	0.45	-1.48
223474_at	C14orf4	0.45	-1.29
213376_at	ZBTB1	0.45	-1.19
226914_at	ARPC5L	0.45	-1.72
201479_at	DKC1	0.45	-1.78
201318_s_at	MRCL3 /// MRLC	0.45	-1.83
200638_s_at	YWHAZ	0.45	-2.08
200851_s_at	KIAA0174	0.45	-1.33
229519_at	FXR1	0.45	-1.19
217779_s_at	PNRC2	0.45	-2.08
209033_s_at	DYRK1A	0.45	-1.11
204446_s_at	ALOX5	0.46	-1.36
224606_at	KLF6	0.46	-1.33
221230_s_at	ARID4B	0.46	-1.25
200662_s_at	TOMM20	0.46	-2.08
209619_at	CD74	0.46	-1.44
204912_at	IL10RA	0.46	-1.55
200840_at	KARS	0.46	-2.08
201934_at	PRO2730	0.46	-2.05
200082_s_at	RPS7	0.46	-1.64
200081_s_at	RPS6	0.46	-1.97
201574_at	ETF1	0.46	-2.02
201385_at	DHX15	0.46	-2.08
200909_s_at	RPLP2	0.47	-1.39
200094_s_at	EEF2	0.47	-1.50
209572_s_at	EED	0.47	-1.25
211762_s_at	KPNA2	0.47	-1.44
201356_at	SF3A1	0.47	-1.83
208103_s_at	ANP32E	0.47	-1.19
200631_s_at	SET	0.47	-2.08
200072_s_at	HNRPM	0.47	-2.02
208788_at	ELOVL5	0.48	-2.08
201498_at	USP7	0.48	-1.62
217028_at	CXCR4	0.48	-1.58
214317_x_at	RPS9	0.48	-1.50
208319_s_at	RBM3	0.48	-1.89
200754_x_at	SFRS2	0.48	-2.08
238035_at	SP3	0.49	-1.22
200626_s_at	MATR3	0.49	-1.97
209323_at	PRKRIR	0.49	-1.44
211939_x_at	BTF3	0.49	-2.08
222465_at	C15orf15 /// LOC	0.49	-2.00
225932_s_at	HNRPA2B1	0.49	-2.08
208736_at	ARPC3	0.50	-1.91
229813_x_at	DAZAP1	0.50	-1.86
206055_s_at	SNRPA1	0.50	-1.97
202644_s_at	TNFAIP3	0.50	-1.30
204118_at	CD48	0.50	-1.22
202157_s_at	CUGBP2	0.50	-2.02

Table S5. B cell and plasma cell biological networks.

Networks associated to B cells

ID	Molecules in Network	Score	Focus Molecules	Top Functions
1	ACTB, CCDC6, CDC2L2, COTL1, DDX21, DEK, ELF1, ENO1, ERK, ETS, ETS1, FBL, HIST4H4 (includes EG:121504), HNRNPA1, HNRNPA2B1, HNRNPC, HNRNPU, IVNS1ABP, MKNK2, PPIA (includes EG:5478), PRDM2, RAN, RBMX, RP6-213H19.1, RPS7, SET, SFRS2, SFRS11, SFRS12, SH2B3, Sos, SP100, SRRM1, TACC1, TRA2B	61	32	RNA Post-Transcriptional Modification, Cancer, Cellular Movement
2	ALOX5, BHLHE40, CXCR4, Cyclin A, E2f, EED, FSH, HADHA, hCG, Histone h3, IGHM, KRAS, MCM2, MCM5, MCM6, MCM7, Mek, MMD, MTPN, P38 MAPK, PIK3CD, PMAIP1, PTPRC, RAB8B, RASSF2, RPS9, SLC2A3, SP3, TCF3, TFDP1, TGFB2, TUBA1A, Vegf, YY1, ZFP36L1	46	27	Cellular Development, Hematological System Development and Function, Hematopoiesis
3	Caspase, CD3, CD52, CD55, CSE1L, EEF2, FTH1, Hdac, HISTONE, Histone h4, Hsp70, Hsp90, HSP90AA1, HSP90AB1, HSPA9, Importin alpha, Importin beta, Jnk, KARS, KPNA2, MAP4K1, MAP4K4, NFKBIE, NUP153, PFN1, PGK1, QARS, RARS, RPL22, RPLP2, RUNX3, Sapk, SLBP, TPM3, YWHAZ	39	24	Cancer, Gastrointestinal Disease, Cell Signaling
4	BLK, CD69, CD74, CD83, GAS5, HLA-DMA, HLA-DMB, HLA-DPA1, HLA-DPB1, HLA-DQA1, HLA-DQB1, HLA-DR, HLA-DRA, HLA-DRB1, HLA-DRB4, HMBG1 (includes EG:3146), IFN Beta, Ifn gamma, IL12 (complex), Interferon alpha, IRF8, LTB, LYN, MHC Class II, Mhc ii, MHC II-β, Mhc2 Alpha, MS4A1, NFKB (complex), NFKBIZ, RFTN1, RNASE2, TCR, Tir, WTAP	37	23	Antigen Presentation, Cell-mediated Immune Response, Humoral Immune Response
5	Actin, AHNK, Akt, Arp2/3, ARPC2, ARPC3, ARPC1B, ARPC5L (includes EG:81873), BCR, CAMLG, Cofilin, CORO1A, CYFIP2 (includes EG:26999), EZR, F Actin, Fcgr1, FCGR1A/2A/3A, FNBP1, GNA12, Iic, MRCL3, Nfat (family), PDPK1, PHF20, Pld, PLEKHA2, PRKCB, Rac, Ras, Ras homolog, RASGRP2, RHOG, RHOH, Rock, STK17A	26	20	Cellular Assembly and Organization, Cell Morphology, Embryonic Development
6	ARRB1, BCLAF1, C16ORF80, CDK5, CHD1 (includes EG:1105), CLTCL1, CSNK2A1, DDX47, E2F4, EIF1AD, EIF2C2, GAPDH (includes EG:2597), GLTSCR2, HBXIP, HDAC3, HNF1A, HNF4A, IER5, KPNB1, LYAR, MIB1, NCOR1, PCNP, PPP4R1, PPTC7, PWP1, RAP2C, RSL24D1, RXRA, SNX5, STAT1, TLN1, WASL (includes EG:8976), YWHAG	21	15	Infection Mechanism, Gene Expression, Lipid Metabolism
7	14-3-3, ALP, ANKRD13A, Ap1, Calmodulin, CaMKII, Cytochrome c, DYRK1A, ELOVL5, ERK1/2, FABP5, G alphas, GNG2, HLA-E, IgG, IL1, IL10RA, Insulin, KLF6, LAPTM5, LDL, Mapk, MIR124, Pdgf, PDGF BB, PI3K, PIP5K3, Pka, Pkc(s), PSMB4, RPS6, SNX9 (includes EG:51429), SWAP70, TNFAIP3, Tubulin	21	15	Carbohydrate Metabolism, Lipid Metabolism, Molecular Transport
8	AMD1, ARHGAP25, ATAD2, ATP, BLOC1S2, CASP9, CD48, CTBP1, CXCR5, FBXL10, FNBPA, FOXP1, FOXP2, FXYD2, GLO1, HTT, IFT57, IL6, JUN, Jun-ATF2, NGFR, NSMAF, P2RX1, P2RX2, P2RX4, P2RX5, P2RX6, PRDM4, SBD5, SERPINA3K (includes EG:20714), SLC01A1, SNRPB, testosterone, TMC6, TMC8	20	15	Cardiovascular System Development and Function, Dermatological Diseases and Conditions, Genetic Disorder
9	AGT, ANP32B, ASAH2, CLGN, CSNK1G2, CTSZ (includes EG:1522), DAZAP1, DKC1, ELAVL1, EPO, ESR1, ETF1, FN1, HNRNPA0, HNRNPM, LCP1, LSS, LTB2, NUP88, PDLIM2, PRKRIR, PUS1, RPL36 (includes EG:25873), RPS13, RPS4Y1, SAPS2, SEC22B, SF1, SF3A1, SLC14A2, SNN, TM4SF1, TNF, TNS1, UGCG	18	14	Organismal Injury and Abnormalities, Lipid Metabolism, Molecular Transport
10	ABCA2, ABCC6, AFG3L1, AFG3L2, ATP8, ATP11B, ATP13A2, ATP13A5, ATP5H (includes EG:10476), ATP5S, ATPase, C14ORF4, DAZAP2 (includes EG:9802), DDX39, DDX3Y (includes EG:26900), DHX8, DHX15, DHX16, DQX1, EFHD2, IMPDH2, MDN1 (includes EG:362498), MIR126, MIR1 (human), NTP, PICK1, PSMD6, PTMAP7, RNF138, RSRC2, TAGLN2, TRIM22, UBQLN4, USP7, WRNIP1	17	13	DNA Replication, Recombination, and Repair, Energy Production, Nucleic Acid Metabolism
11	ABCB4, ATP6V1B2, BCAP29, BLMH, CCDC93, CDH13, CHD2, CMTM6, COX15, COX4I1, EIF4A1, EPS15L1, FAM100B, GGA2, HGF, IDH2, INPP5E, KCNK1, MIR125B1, NOVA1, PDLIM1, PLOD1, PNRC1, PRDX3, progesterone, RAVER1, ROD1, RPL11, RPL13A, RPS2, RPS21, SEC61A1, SLC2A4, SPSB1, TUBB6	15	12	Cell Morphology, Carbohydrate Metabolism, Cellular Growth and Proliferation
12	AMIGO3, ARF5, ARF6, BTF3, Ck2, CYTH1, EIF2S2, FBXO11, FXR1, GGNBP2, GSPT1, GTF2H1, HOXB6, IPCEF1, IQSEC1, MIR199A1, MIRN325, MVP, NAP1L1, NKRF, PHTF2, PNN, POLB, POLR2F, PTMA, RNA polymerase II, RNF111, SNRPA1, SUB1, SYT4, TBX2, TRIM23, UBE2R2 (includes EG:54926), YBX1, ZNF238	15	12	Cell Signaling, Nucleic Acid Metabolism, Small Molecule Biochemistry
13	14-3-3(β,γ,θ,η,ζ), APOL3 (includes EG:80833), ARID4B, CCNO, CKAP2, CRTC1, CUL4B, DUT (includes EG:1854), E2F1, EIF1, FUSIP1, IGF1R, KLC4, LARP1, MFAP1, NR3C1, OSBPL3, PCNA, PTP4A2, RAB11FIP1, RASSF8, RBM3, RRAGC, SHROOM2, SLC25A6, SMU1, TBC1D1, USP1, USP37 (includes EG:57695), WDR26, WDR76, WDR82, YWHAD, YWHAG, YWHAH	15	12	Cellular Development, Endocrine System Development and Function, Lipid Metabolism
14	AIM1 (includes EG:202), APOD, ARIH2, BCCIP, CDC73, CDH10, CTNNB1, CTNNBP1, CTNNBP2, CTNNBP2NL, DLG5, FAM40A, HNRNPH3, ITSN2, JOSD1, KIAA0174, LSM14A, MIR206, MIR24-1, NUFIP2, NXN, POU3F2, PPP2R1A, PTN, RAB8B, RP5-1000E10.4, SLC12A2, SLC25A36, SLC6A2, SP8, STK24, TOMM20, TRAF3IP3, ZBTB1, ZBTB24 (includes EG:9841)	15	12	Gene Expression, Organismal Development, Endocrine System Disorders
15	ACSM3, ATAD4, BANK1, beta-estradiol, CCDC85B, CDC123, CDC42SE1, CNN2, CUGBP2, ERBB2, FAM76B, FEZ2, HSF2BP, IDI1, KDELR3, KLK11, LRRFIP1, MATR3, MOBKL1B, MPHOSPH9, MSMB, NNMT, PCBP1 (includes EG:5093), PLEKHF2 (includes EG:79666), PNRC2 (includes EG:55629), SLC35A5, SOLH, SPAG4, SPOCK1, STAT3, STMN3, TGFB1, TSPYL4, Ubiquitin, ZFP36	14	11	Drug Metabolism, Lipid Metabolism, Small Molecule Biochemistry
16	APTX, ZNF639	2	1	DNA Replication, Recombination, and Repair, Genetic Disorder, Neurological Disease
17	C6ORF48, CFTR	2	1	Cell Morphology, Digestive System Development and Function, Endocrine System Development and Function

18	FANCC, PION	2	1	Cell Cycle, Gene Expression, RNA Post-Transcriptional Modification
19	ANP32E, MIR195	2	1	Cellular Compromise, Skeletal and Muscular Disorders, Inflammatory Disease
20	DNAJC, DNAJC9, Hsp22/Hsp40/Hsp90	2	1	

Networks associated to plasma cells

ID	Molecules in Network	Score	Focus Molecules	Top Functions
1	ALG2, ARFGAP3, C2ORF30, DAD1, DDOST, Dolichyl-diphosphooligosaccharide-protein glycotransferase, GOLPH3L, HSPA13, IGKC, KDELR2, KRTCAP2, LMAN2, LY96, MGAT2, Nfkb (complex), OSTC, PRDM1, PRDX4, RPN1, RPN2, RSAD2, SEC11C, SEC23B, SEL1L, SPCS2, SRP54, SSR1, SSR4, STT3B, TM6IM4, TNFRSF17, TRAM1, TXNDC5, TXNDC11, XBP1	67	33	Post-Translational Modification, Cellular Development, Hematological System Development and Function
2	APOBEC3G, BTG2, DUSP5, ERK, ERP44, IFI6, IFI35, IFIH1, IFIT1, IFN Beta, Ifn gamma, IFNAR2, IL12 (complex), IL6ST, Interferon alpha, IRF7, ISG20, ISG15 (includes EG:9636), ISGF3, JAK, MEF2C, MHC Class I (complex), MHC Class II, MX1, OAS1, OAS2, PSME2, STAT, STAT1, STAT2, Statt1-Stat2, TLR7, TM6IM6, TNFSF10, TRIB1	40	24	Antigen Presentation, Antimicrobial Response, Cell-mediated Immune Response
3	C11ORF10, CABC1, CRTAP, CYTH2, EDEM3, ERAP1, FAM160A2, FKBP7, FKBP10, FKBP11, FKBP14, GGCX, GNG5, GNS, HNF4A, IL1B, ISOC1, KLHL6, NBR1, NUCB2, PPIL1, PPIL2, PRCP, RABAC1, SEC11C, SPCS2, SPCS3, SRP54, SSR2, SSR3, TMEM176B, TMEM59 (includes EG:9528), UAP1, XBP1, YIF1A	35	21	Lipid Metabolism, Molecular Transport, Small Molecule Biochemistry
4	ACADM, Ap1, Caspase, CD27, CD38, CD59, CDKN2C, CTSS, Cytochrome c, ERK1/2, Fgf, GLG1, GRN, Histone h3, IGHG1, IGHM, IGL@, Igm, Ikb, IKK (complex), IL1, Insulin, Jnk, LAP3, LAX1, MAGED1, MGC29506, P38 MAPK, PECAM1, peptidase, SCARB2, SEC31A, SPCS3, TPP1, Ubiquitin	33	20	Cell-To-Cell Signaling and Interaction, Hematological System Development and Function, Humoral Immune Response
5	ADA, Akt, ALG5, CAV1, CD63, Collagen(s), CYBA, Ezf, EPOR, FOXO3, GUSB, ICAM2, INPP4A, Integrin, Integrin alpha 4 beta 1, ITGA6, LAMP2, LDL, MAN1A1, MANEA, Mannosidase Alpha, Mapk, NPC2, Pdgf, PDGFB, PI3K, Pld, Ras, SAR1B, SDC1, STAT5a/b, Tgf beta, TPD52, VCAM1, Vegf	30	19	Cancer, Cellular Movement, Reproductive System Disease
6	ARMET, BACE1, BHLHE41, CNPY2, COPB2, GLRX2, GORASP2, HIF1A, hydrogen peroxide, IDH2, IKBKE, ITM2C, MLEC, NADH dehydrogenase, NDUFA2, NDUFA3, NDUFA11, NDUFA10 (includes EG:4705), NDUFA4L, NDUFAB1, NDUFB2, NDUFB4, NDUFB6, NDUFB7, NDUFB11, NDUFV3, PDIA4, PDK1, SEC14L1, SELS, TMED9, TMED10, TRAF6, VCP, ZAP70	23	16	Cancer, Cell Cycle, Cell Death
7	AGT, AIFM3, ANAPC13, APC, APC-CD20, APC-FZR1, CABC1, CASP3, CEBPA, CKAP2, Corticosteroid-GCR, EBAG9, FAM3C, FNDC3A, GALNT2, GLIPR1, H1FX, HDLBP, IGKV1-5, KDELR1, LETMD1, MIRLET7A1, MMRN1, NFYB, NMT2, NR3C1, Poly ADP-ribose polymerase, REEP5, SERINC3, SERPINI1, SESN1, SPPL2B, TP53, USO1, WDR33	19	14	Cell Cycle, Cell Death, Dermatological Diseases and Conditions
8	ARF4, ATP6V0E1, C12ORF23, CD164, CREB3L2, DNAJB7, DNAJB8, DNAJB9, DNAJB11, DNAJB12, DNAJB13, DNAJB14, DNAJC1, DNAJC4, DNAJC6, DNAJC8, DNAJC9, DNAJC15, DNAJC16, DNAJC17, DNAJC18, DNAJC19, DNAJC21, DNAJC5B, DNAJC5G, DYLL1, FBXW7, FSH, Hsp22/Hsp40/Hsp90, MIR124, MIR1 (human), PDXK, SERP1, SLC25A30, SLC44A1	19	13	Cell Morphology, Carbohydrate Metabolism, Drug Metabolism
9	AKR1A1, AMPD1, Ap2a2-Cltc-Hd, ARMCX3, BPI, butyric acid, C8ORF66, CCPG1, CDKN2A, CLTC, CMF2K, COMMD3, CPNE5, CYP2D12, DTYMK, DYLLRB1, EMP3, GPRC5A, HDGF, HTT, HUNK, IFNA2, ITM2B, NFKB1, Proteasome, retinoic acid, RPL5 (includes EG:19983), SEC22B, SRGN, TPR, UBE2L6, UBE2S, UQCRC, UQCRCQ, ZNF133	19	13	Cellular Development, Cellular Growth and Proliferation, Reproductive System Development and Function
10	AIM2, CCR6, CECR1, CIC, CTSH, CYB561, ESM1, FASLG, FNDC3B, HEXB, HIRA, HIRIP3, HIST1H2BK, IFI30, IFNG, KIAA1370, LAMP3, LY6A, MEFV, MIRN292 (includes EG:100049711), NCAN, PHF15, PNOC, SEC62, SMTN, SNX18, TGFB1, TMEM184B, TPST2, TREM1, TRIM22, TTC28, TYMP, UBE2J1, VIPR2	17	12	Cellular Function and Maintenance, Cell-To-Cell Signaling and Interaction, Cell Death
11	ACTB, APOBEC3B, B4GALNT1, BTN3A3, BTNL2, C19ORF10, CCRN4L, CD276, CD1C, CHI3L3 (includes EG:12655), CHST2, EAF2, ELAVL4, GALNAC4S-6ST, GBP1 (includes EG:14468), GM2A, HCK, HRSF12, IFI203, IKBKG, IL4, IL19, KYNU (includes EG:8942), METTL7A, MME, MRPS31, RBP3, RPS27L (includes EG:51065), SDF4, SLAMF7, STARD3, THOP1, TNF, TXLNA (includes EG:200081), Vacuolar H+ ATPase	15	11	Cardiovascular Disease, Inflammatory Disease, Lipid Metabolism
12	AKR1B7, Androgen-AR, AR, AR-HSP90, C4A, Ck2, DHT-AR, dihydrotestosterone, ERGIC2, FAM69A, GLCC11, GTF2A1, GTF2A2, GTF2F1, HSP90AB1, INSL3, LCN5, MAK, NANS, NCOA4, NR5A1, PAK6, PBSN, Pka, RNA pol2-transcription factor, RNF14, SEC24A, SELENBP1, SUGT1, SVIL, SVS2, TARP, TFIIF, TMF1, TRIP13	7	6	Organ Development, Reproductive System Development and Function, Gene Expression
13	FCRL5, PTPN6	2	1	Cell-To-Cell Signaling and Interaction, Cell-mediated Immune Response, Cellular Growth and Proliferation
14	BSCL2, TMEM19	2	1	Endocrine System Disorders, Genetic Disorder, Metabolic Disease
15	ZBTB4, ZBTB38	2	1	Gene Expression
16	ERGIC1, ERGIC3	2	1	Molecular Transport, Protein Trafficking
17	HOXA9, SERINC2	2	1	Cancer, Gene Expression, Hematological Disease
18	IgD, IGHG	2	1	Connective Tissue Disorders, Dermatological Diseases and Conditions, Genetic Disorder
19	KCTD15, PPA1, WIP1	2	1	Carbohydrate Metabolism, Nucleic Acid Metabolism, Small Molecule Biochemistry

Supplemental materials. Monoclonal antibodies.

Mouse (or rat when indicated) monoclonal antibodies (mAbs) conjugated to Alexa Fluor (AF) 488, AF 647, allophycocyanin (APC), APC-H7, APC-cyanin 7 (-Cy7), fluorescein isothiocyanate (FITC), peridinin chlorophyll protein-cyanin 5.5 (PerCP-Cy5.5), phycoerythrin (PE), PE-Cy7, specific for human CD19 (clones HIB19 and SJ25C1), CD27 (clones L128 and M-T271), CD38 (clone HIT2), CD43 (clone 1G10), CD45 (clones HI30), CD62L (clone DREG-56), CD138 (clone MI15), CD184 (CXCR4, clone 12G5), HLA-DR, DP, DQ (clone Tu39), Ig light chain lambda (Ig λ , clone JDC-12), Ig light chain kappa (Ig κ , clone TB 28-2), IgG (clone G18-145), IgM (clone G20-127), and Ki67 (clone B56) were purchased from BD Biosciences (Le Pont De Claix, France); CD20 (clone B9E9), and CD138 (clone B-A38) from Beckman Coulter (Fullerton, CA); CCR10 (rat, clone 314305) from R&D Systems (Minneapolis, MN); CD62L (clone DREG-56) and CD200 (clone OX104) were from eBiosciences (San Diego, CA); IgA (polyclonal goat antibody) and IgG (polyclonal goat Ab) from Southern Biotech (Birmingham, AL).