Table 1. Representative Ohnologs mapping to the MHC/neurotrophin- and HOX-paralogons

	Genes with immunologic functions	Location[a]	Function	Other members mapping to the paralogons	Location[a]
MHC/neurotrophin paralogons					
Genes involved in antigen processing					
20S proteasome β-subunits	*PSMB8*	6p21.3 (MHC)	Production of MHC class I-binding peptides	*PSMB5*	14q11.2
	PSMB9	6p21.3 (MHC)	Production of MHC class I-binding peptides	*PSMB7*	9q34.11-q34.12
	PSMB11	14q11.2	Positive selection of CD8+ T cells?		
TAP	*TAP1*	6p21.3 (MHC)	Transport of peptides into the endoplasmic reticulum	*ABCB9 (TAPL)*	12q24
	TAP2				
Tapasin	*TAPBP*	6p21.3 (MHC)	Promotes association of TAP and MHC class I molecules	*TAPBPL*	12p13.3
Cathepsins	*CTSL*	9q21-q22	CD4+ T cell and NKT cell development	*CTSH*	15q24-q25
	CTSL2	9q22.2	CD4+ T cell and NKT cell development	*CTSK*	1q21
	CTSS	1q21	Removal of invariant chains in B cells and dendritic cells	*CTSG*	14q11.2
	CTSD	11p15.5	Production of MHC class II-binding peptides	*CTSC*	11q14.1-q14.3
				CTSF	11q13.1
				CTSW	11q13.1
Genes involved in expression of MHC molecules					
Retinoid X receptor	*RXRB*	6p21.3 (MHC)	MHC class I expression	*RXRA*	9q34.3
				RXRG	1q22-q23
Regulatory factor X	*RFX5*	1q21	MHC class II expression	*RFX1*	19p13.1
				RFX2	19p13.3-p13.2
				RFX3	9p24.2
				RFX4	12q24
Complement genes					
Complement components	*C3*	19p13.3-p13.2	A central component of complement activation	*A2M*	12p13.3-p12.3
	C4A, C4B	6p21.3 (MHC)	Component of the classical pathway		
	C5	9q34.1	Component of the classical pathway		
Cytokine and granzyme genes					
Tumor necrosis factor (TNF) superfamily ligands	*LTA (TNFSF1)*	6p21.3 (MHC)	Lymphotoxin α: inflammation, lymphoid organ development	*TNFSF15*	9q32
	TNF (TNFSF2)	6p21.3 (MHC)	Tumor necrosis factor α: cytokine produced by monocytes		
	LTB (TNFSF3)	6p21.3 (MHC)	Lymphotoxin β: inflammation, lymphoid organ development		
	TNFSF4	1q25	OX40 ligand: activation of B cells and macrophages		
	TNFSF6	1q23	Fas ligand: apoptosis of Fas-expressing cells		
	TNFSF8	9q33	CD30 ligand: B cell proliferation		
	TNFSF9	19p13.3	4-1BB-L: activation-induced cell death and T cell proliferation		
	TNFSF14	19p13.3	LIGHT : : T cell proliferation		
	TNFSF18	1q23	GITRL : modulation of T cell survival		
Granzyme	*GZMB, GZMH*	14q11.2	Serine proteases of NK and T cells involved in target cell killing		
	GZMM	19p13.3			
	GZMA, GZMK	5q11-q12			

Genes involved in signal reception or transduction

Janus kinases	*JAK1*	1p31.3	Cytokine signaling (IL-2, IL-4, IL-6, IFN-α/β, IFN-γ, etc.)		
	JAK2	9p24	Cytokine signaling (IL-3, IFN-γ, etc.)		
	JAK3	19p13.1	Cytokine signaling (IL-2, IL-4, IL-7, etc.)		
	TYK2	19p13.2	Cytokine signaling (IL-10, IL-12, IFN-α/β, IFN-γ, etc.)		
PIAS (Protein inhibitor of activated STAT) [b]	*PIAS1*	15q22	Inhibitor of activated STAT1		
	PIAS3	1q21	Inhibitor of activated STAT3		
	PIAS4	19p13.3	Inhibitor of activated STAT4		
VAV	*VAV1*	19p13.3-p13.2	T and B cell development and activation	*VAV2*	9q34
				VAV3	1p13.3
NOTCH	*NOTCH1*	9q34.3	T cell development	*NOTCH2*	1p13-p11
				NOTCH3	19p13.2-p13.1
				NOTCH4	6p21.3 (MHC)
CSK	*CSK*	15q23-q25	Signal transduction through the T cell receptor		
	CHK (MATK)	19p13.3	Signal transduction in immune cells		

HOX paralogons

Genes coding for transcription factors

STAT transcription factors	*STAT1*	2q32.2	Cytokine signaling (IFN-α/β, IFN-γ)		
	STAT2	12q13.2	Cytokine signaling (IFN-α/β)		
	STAT3	17q21.31	Cytokine signaling (IL-6, IL-10)		
	STAT4	2q32.2-q32.3	Cytokine signaling (IL-12)		
	STAT5A	17q11.2	Cytokine signaling (IL-2, IL-7, IL-9)		
	STAT5B	17q11.2	Cytokine signaling (IL-2, IL-7, IL-9)		
	STAT6	12q13	Cytokine signaling (IL-4)		
SP transcription factors	*SP2*	17q21.32	T cell transcriptional regulatory element	*SP1*	12q13.1
				SP3	2q31
				SP4	7p15

Cytokine genes

Chemokines					
CC chemokines	*CCL1,2,3,4,5,7,*	17q11-q12	Recruitment of leukocytes to sites of infection		
	8,11,13,14,15,		Regulation of the traffic of leukocytes including T cells,		
	16,18,23		B cells and dendritic cells		
	CCL20	2q33-q37	Development of nonlymphoid organs		
Chemokine receptors					
CC chemokine receptors	*CCR1,2,3,5,8,9,*	3p21-p22	Recruitment of leukocytes to sites of infection		
	CCRL2		Regulation of the traffic of leukocytes including T cells,		
	CCR4	3p24	B cells and dendritic cells		
	CCR7,10	17q12-q21.2	Development of nonlymphoid organs		
CXC chemokine receptors	*IL8RA, IL8RB*	2q35			
	CXCR4	2q21			
	CXCR6	3p21			
	CXCR7	2q37.3			
Others	*CX3CR1, XCR1*	3p21.3-p21.1			

[a] Chromosomal localization of human genes based on the OMIM database (http://www.ncbi.nlm.nih.gov/omim) or Entrez gene (http://www.ncbi.nlm.nih.gov/sites/entrez?db=gene).
[b] PIAS2, an inhibitor of activated STAT2, maps to 18q12.1-q12.3.