

Additional File 1: Table S1. Atopy-related genes from the Human Gene Mutation Database

Gene symbol	Gene description	Atopic symptom involved	Number of atopy mutations	Cluster*
<i>ADCYAP1R1</i>	Adenylate Cyclase Activating Polypeptide 1 Receptor Type I	Asthma	NA	A
<i>CCL11</i>	C-C Motif Chemokine Ligand 11	Asthma	NA	A
<i>COL6A5</i>	Collagen Type VI Alpha 5 Chain	Dermatitis	4	A
<i>CTNNA3</i>	Catenin Alpha 3	Food allergy	2	A
<i>FRMD6</i>	FERM Domain Containing 6	Asthma	1	A
<i>KCNMB1</i>	Potassium Calcium-Activated Channel Subfamily M Regulatory Beta Subunit 1	Asthma	1	A
<i>LRRC32</i>	Leucine Rich Repeat Containing 32	Dermatitis	6	A
<i>MYLK</i>	Myosin Light Chain Kinase	Asthma	1	A
<i>NGFR</i>	Nerve Growth Factor Receptor	Asthma	NA	A
<i>SELP</i>	Selectin P	Atopy	1	A
<i>SERPINA1</i>	Serpin Family A Member 1	Asthma	1	A
<i>SERPINE1</i>	Serpin Family E Member 1	Asthma	NA	A
<i>ST5</i>	Suppression Of Tumorigenicity 5	Asthma	1	A
<i>TWIST1</i>	Twist Family BHLH Transcription Factor 1	IgE	NA	A
<i>PARP1</i>	Poly(ADP-Ribose) Polymerase 1	Asthma	NA	B
<i>TUFM</i>	Tu Translation Elongation Factor, Mitochondrial	Asthma	1	B
<i>FCERIA</i>	Fc Fragment Of IgE Receptor Ia	Dermatitis	1	C
<i>HRH4</i>	Histamine Receptor H4	Dermatitis	NA	C
<i>IL1RL1</i>	Interleukin 1 Receptor Like 1	Dermatitis	2	C
<i>IL4</i>	Interleukin 4	IgE Asthma	3	C
<i>IL13</i>	Interleukin 13	Atopy IgE Asthma Rhinitis	2	C
<i>MS4A2</i>	Membrane Spanning 4-Domains A2	Atopy IgE Asthma Rhinitis	5	C
<i>SLC6A12</i>	Solute Carrier Family 6 Member 12	Asthma	1	C
<i>ADRB2</i>	Adrenoceptor Beta 2	Dermatitis Asthma	2	D
<i>ALOX5</i>	Arachidonate 5-Lipoxygenase	Asthma	1	D
<i>ARPC1B[†]</i>	Actin Related Protein 2/3 Complex Subunit 1B	Allergy	1	D
<i>BTK[‡]</i>	Bruton Tyrosine Kinase	Asthma	1	D
<i>CD14</i>	Cluster of Differentiation 14 Molecule	Asthma Rhinitis	NA	D
<i>CD86</i>	Cluster of Differentiation 86 Molecule	Asthma	1	D
<i>CSF1R</i>	Colony Stimulating Factor 1 Receptor	Asthma	1	D
<i>CYSLTR1</i>	Cysteinyl Leukotriene Receptor 1	Atopy Asthma	2	D

<i>FCGR2B</i>	Fc Fragment Of IgE Receptor Iib	Atopy	NA	D
<i>HLX</i>	H2.0 Like Homeobox	Asthma	2	D
<i>HNMT</i>	Histamine N-Methyltransferase	Dermatitis Asthma	NA	D
<i>IL6R</i>	Interleukin 6 Receptor	Dermatitis	NA	D
<i>IL18</i>	Interleukin 18	Asthma	1	D
<i>INPP4A</i>	Inositol Polyphosphate-4-Phosphatase Type I A	Asthma	1	D
<i>IRAK3</i>	Interleukin 1 Receptor Associated Kinase 3	Asthma	2	D
<i>IRF2</i>	Interferon Regulatory Factor 2	Dermatitis	1	D
<i>MMP9</i>	Matrix Metalloproteinase 9	Asthma Allergy	2	D
<i>MMP12</i>	Matrix Metalloproteinase 12	Asthma	NA	D
<i>NLRP3</i>	NLR Family Pyrin Domain Containing 3	Food allergy	2	D
<i>NOD1</i>	Nucleotide Binding Oligomerization Domain Containing 1	IgE Asthma	1	D
<i>NOD2</i>	Nucleotide Binding Oligomerization Domain Containing 2	Atopy Dermatitis Rhinitis	NA	D
<i>ORAI1</i> [†]	Calcium Release-Activated Calcium Modulator 1	Dermatitis	1	D
<i>PLA2G4A</i>	Phospholipase A2 Group IVA	Asthma	2	D
<i>PLA2G7</i>	Phospholipase A2 Group VII	Atopy Asthma	2	D
<i>PTGER2</i>	Prostaglandin E Receptor 2	Asthma	1	D
<i>STAT6</i>	Signal Transducer And Activator Of Transcription 6	IgE Dermatitis Asthma	3	D
<i>TLR2</i>	Toll Like Receptor 2	Dermatitis Asthma	1	D
<i>TLR6</i>	Toll Like Receptor 6	Asthma	1	D
<i>TLR9</i>	Toll Like Receptor 9	Dermatitis Asthma	1	D
<i>CCL2</i>	C-C Motif Chemokine Ligand 2	Asthma	NA	E
<i>CCL7</i>	C-C Motif Chemokine Ligand 7	Asthma	1	E
<i>CTLA4</i> [†]	Cytotoxic T-Lymphocyte Associated Protein 4	Asthma	1	F
<i>EPHX1</i>	Epoxide Hydrolase 1	Asthma	NA	F
<i>ICOS</i> [†]	Inducible T Cell Costimulator	Allergy	1	F
<i>IL2</i>	Interleukin 2	Allergy	2	F
<i>IL7R</i> [†]	Interleukin 7 Receptor	Dermatitis	NA	F
<i>IL12RB1</i> [†]	Interleukin 12 Receptor Subunit Beta 1	Dermatitis	1	F
<i>IL17RB</i>	Interleukin 17 Receptor B	Asthma	1	F
<i>IL21</i> [†]	Interleukin 21	Asthma	1	F
<i>IL21R</i> [†]	Interleukin 21 Receptor	IgE	1	F
<i>ITK</i> [†]	Interleukin 2 Inducible T Cell Kinase	Asthma	1	F
<i>LTA</i>	Lymphotoxin Alpha	Asthma	1	F
<i>PDCD4</i>	Programmed Cell Death 4	Asthma	1	F
<i>PECAMI</i>	Platelet And Endothelial Cell Adhesion	Asthma	NA	F

	Molecule 1			
<i>PPARGC1B</i>	Peroxisome Proliferator-Activated Receptor Gamma Coactivator 1 Beta	Asthma	2	F
<i>S1PR1</i>	Sphingosine-1-Phosphate Receptor 1	Asthma	2	F
<i>TBXA2R</i>	Thromboxane A2 Receptor	IgE Dermatitis Asthma	2	F
<i>TRAF3IP2[†]</i>	TNF Receptor-Associated Factor 3 Interacting Protein 2	Dermatitis	2	F
<i>ZPBP2</i>	Zona Pellucida Binding Protein 2	Asthma	2	F
<i>CAT</i>	Catalase	Asthma	1	G
<i>SMPD1</i>	Sphingomyelin Phosphodiesterase 1	Allergy	1	G
<i>CD53</i>	Cluster of Differentiation 53 Molecule	Asthma	1	H
<i>DOCK8[†]</i>	Dedicator Of Cytokinesis 8	IgE	45	H
<i>STK10</i>	Serine/Threonine Kinase 10	Asthma	1	H
<i>TGFB1</i>	Transforming Growth Factor Beta 1	Asthma	NA	H
<i>TYK2[†]</i>	Tyrosine Kinase 2	IgE	1	H
<i>GSTP1</i>	Glutathione S-Transferase Pi 1	Dermatitis Asthma	NA	I
<i>PGM3[†]</i>	Phosphoglucomutase 3	Atopy IgE	6	I
<i>CCL5</i>	C-C Motif Chemokine Ligand 5	Dermatitis Asthma	1	J
<i>CYSLTR2</i>	Cysteinyl Leukotriene Receptor 2	Atopy	1	J
<i>IFNG</i>	Interferon Gamma	Atopy	NA	J
<i>IL12RB2</i>	Interleukin 12 Receptor Subunit Beta 2	Atopy	3	J
<i>TBX21</i>	T-Box 21	Asthma	1	J
<i>BDNF</i>	Brain Derived Neurotrophic Factor	Asthma	NA	K
<i>CCL26</i>	C-C Motif Chemokine Ligand 26	Asthma	1	K
<i>CDHR3</i>	Cadherin Related Family Member 3	Asthma	1	K
<i>CFTR[†]</i>	Cystic Fibrosis Transmembrane Conductance Regulator	Asthma	6	K
<i>CHIA</i>	Chitinase, Acidic	IgE Asthma	6	K
<i>CHIT1</i>	Chitinase 1	Asthma	NA	K
<i>DBH</i>	Dopamine Beta-Hydroxylase	Asthma	NA	K
<i>FLG2</i>	Filaggrin Family Member 2	Dermatitis	1	K
<i>GC</i>	GC, Vitamin D Binding Protein	Asthma	NA	K
<i>GSDMA</i>	Gasdermin A	Asthma	1	K
<i>GSTO2</i>	Glutathione S-Transferase Omega 2	Asthma	NA	K
<i>IL9</i>	Interleukin 9	Dermatitis	1	K
<i>IL31</i>	Interleukin 31	Dermatitis	1	K
<i>KLK7</i>	Kallikrein Related Peptidase 7	Dermatitis	1	K
<i>NOS1</i>	Nitric Oxide Synthase 1	Asthma	1	K
<i>NOS2</i>	Nitric Oxide Synthase 2	Atopy	NA	K
<i>PTGDR</i>	Prostaglandin D2 Receptor	Asthma Allergy	4	K
<i>PTGDR2</i>	Prostaglandin D2 Receptor 2	Asthma	2	K
<i>SCGB1A1</i>	Secretoglobin Family 1A Member 1	Asthma	1	K

<i>SPINK5</i> [†]	Serine Peptidase Inhibitor, Kazal Type 5	Atopy Asthma	3	K
<i>TCHHL1</i>	Trichohyalin Like 1	Dermatitis	1	K
<i>TMEM79</i>	Transmembrane Protein 79	Dermatitis	1	K
<i>TRPV1</i>	Transient Receptor Potential Cation Channel Subfamily V Member 1	Asthma	1	K
<i>ADAM33</i>	ADAM Metallopeptidase Domain 33	Asthma	NA	bin
<i>ATG5</i>	Autophagy Related 5	Asthma	2	bin
<i>CASP8</i> [†]	Caspase 8	Asthma	NA	bin
<i>CD38</i>	Cluster of Differentiation 38 Molecule	Asthma	1	bin
<i>CEP68</i>	Centrosomal Protein 68	Asthma	1	bin
<i>CSF2</i>	Colony Stimulating Factor 2	Dermatitis	1	bin
<i>CSTA</i>	Cystatin A	Dermatitis	1	bin
<i>DEFB1</i>	Defensin Beta 1	Dermatitis	NA	bin
<i>F2RL1</i>	F2R Like Trypsin Receptor 1	Atopy	1	bin
<i>GRASP</i>	General Receptor For Phosphoinositides 1 Associated Scaffold Protein	Asthma	1	bin
<i>GSTM1</i>	Glutathione S-Transferase Mu 1	Dermatitis Asthma	NA	bin
<i>HAVCR1</i>	Hepatitis A Virus Cellular Receptor 1	Asthma	3	bin
<i>HMGB1</i>	High Mobility Group Box 1	Dermatitis	3	bin
<i>IL4R</i>	Interleukin 4 Receptor	Atopy Dermatitis Asthma	6	bin
<i>IL10</i> [†]	Interleukin 10	Asthma	NA	bin
<i>IL12B</i> [†]	Interleukin 12B	Dermatitis Asthma	2	bin
<i>IL17F</i> [†]	Interleukin 17F	Asthma	1	bin
<i>KAT6A</i>	Lysine Acetyltransferase 6A	Food allergy	1	bin
<i>LPL</i>	Lipoprotein Lipase	Dermatitis	NA	bin
<i>LTC4S</i>	Leukotriene C4 Synthase	Asthma Allergy	2	bin
<i>MAP3K1</i>	Mitogen-Activated Protein Kinase 1	Asthma	1	bin
<i>NAT2</i>	N-Acetyltransferase 2	Asthma	2	bin
<i>NFKBIA</i>	Nuclear Factor Kappa B Inhibitor Alpha	Asthma	1	bin
<i>NR3C1</i>	Nuclear Receptor Subfamily 3 Group C Member 1	Asthma	NA	bin
<i>ORMDL3</i>	Orosomucoid Like 3	Asthma	3	bin
<i>PAG1</i>	Phosphoprotein Membrane Anchor With Glycosphingolipid Microdomains 1	Allergy	1	bin
<i>PHF11</i>	PHD Finger Protein 11	Dermatitis Asthma	2	bin
<i>PTGS2</i>	Prostaglandin-Endoperoxide Synthase 2	Atopy Asthma	NA	bin
<i>RBFOX1</i>	RNA Binding Fox-1 Homolog 1	Food allergy	2	bin
<i>SART1</i>	U4/U6.U5 Tri-SnRNP-Associated Protein 1	Atopy	1	bin
<i>SCGB3A2</i>	Secretoglobin Family 3A Member 2	Asthma	1	bin
<i>STAT3</i> [†]	Signal Transducer And Activator Of Transcription 3	IgE	107	bin

<i>TLR1</i>	Toll Like Receptor 1	Asthma	NA	bin
<i>TNF</i>	Tumor Necrosis Factor	Asthma	NA	bin
<i>TNFRSF13B</i> [†]	Tumor Necrosis Factor Receptor Superfamily Member 13B	Asthma	NA	bin
<i>TSLP</i>	Thymic Stromal Lymphopoietin	Asthma	1	bin
<i>ACE</i>	Angiotensin I Converting Enzyme	Asthma	NA	NA
<i>CCL3L1</i>	C-C Motif Chemokine Ligand 3 Like 1	Asthma	NA	NA
<i>CHI3L1</i>	Chitinase 3 Like 1	Asthma	1	NA
<i>CYP2C19</i>	Cytochrome P450 Family 2 Subfamily C Member 19	Asthma	NA	NA
<i>CYP2J2</i>	Cytochrome P450 Family 2 Subfamily J Member 2	Asthma	NA	NA
<i>ERBIN</i>	Erb-B2 Interacting Protein	IgE	1	NA
<i>FCGR2A</i>	Fc Fragment Of IgE Receptor Iia	Atopy Allergy	1	NA
<i>FLG</i>	Filaggrin	Dermatitis Food allergy Asthma	62	NA
<i>FLG10.2</i>	Fillagrin Alternative Isoform, Repeat 10.2	Dermatitis	NA	NA
<i>FLG11</i>	Fillagrin Alternative Isoform, Repeat 11	Dermatitis Asthma	1	NA
<i>GSDMB</i>	Gasdermin B	Asthma	4	NA
<i>LCE3C</i>	Late Cornified Envelope 3C	Dermatitis	NA	NA
<i>MUC7</i>	Mucin 7, Secreted	Asthma	1	NA
<i>TLR10</i>	Toll Like Receptor 10	Asthma Rhinitis	1	NA
<i>VSTM1</i>	V-Set And Transmembrane Domain Containing 1	Dermatitis	1	NA

Abbreviations: NA, not available

* Human atopy-related genes identified in the Human Gene Mutation Database (HGMD) were not available for clustering because they could not be identified in the mouse immune system as used in ImmGen.

[†] Overlapping genes between atopy-related gene list and PID-related gene list (n=22).