SUPPORTING INFORMATION

Methods

Data searches for reported immune-related adverse events

Search terms that were used were “(advanced) melanoma”, “adverse events” or “toxicities”, “immune therapy” and “checkpoint inhibition” to name a few. In addition, search terms used for the introduction include “cancer immunotherapy”, “melanoma”, “melanoma therapy”, “adoptive T-cell therapy”, “checkpoint *inhibitors or *modulator or *antibody or *block”, “immune checkpoint molecules”, “(anti-) *cytotoxic T lymphocyte associated 4 or *CTLA-4”, “ipilimumab”, “(anti-)*Programmed Cell Death 1 or * PD-1), “pembrolizumab”, “nivolumab”, “combination checkpoint therapy”, “neo- adjuvant immune checkpoint therapy”, “immune checkpoint inhibition *toxicities or *adverse events”. Furthermore, we searched for studies reporting on checkpoint inhibition treatment-induced irAEs. Treatment-induced irAEs were cross-searched with genetic alterations found for the corresponding autoimmune disease.

Data searches for SNPs associated with autoimmune diseases

The terms “genetics autoimmune disease”, “genetics autoimmune disease”, “genetic alterations”, “SNPs”, “susceptible loci”, “risk loci” “GWAS” and “polymorphisms” were cross-searched using the following search terms: “autoimmune neuropathies”, “Guillian Barré Syndrome”, “chronic immune demyelinating polyneuropathy”, “enteric neuropathy”, “Hirschsprung disease”, “myasthenia gravis”, “autoimmune myopathies”, “autoimmune cardiomyopathies”, “autoimmune skeletal disease”, “arthritis”, “myocarditis”, “autoimmune dermatologic diseases”, “vitiligo”, “DRESS syndrome”, “Steven-Johnson syndrome”, “toxic epidermal necrolysis”, “psoriasis”, “lichenoid”, “bullous” “alopecia”, “autoimmune gastrointestinal disease”, “inflammatory bowel disease”, “Crohn’s disease”, “ulcerative colitis”, “celiac disease”, “autoimmune hepatitis”, “autoimmune respiratory disease”, “pneumonitis”, “interstitial lung disease”, “pulmonary fibrosis”, "autoimmune hematologic conditions”, “red cell aplasia”, “neutropenia”, “acquired hemophilia A”, “aplastic anemia”, “disseminated intravascular coagulopathy”, “autoimmune endocrinopathies”, “hypophysitis”, “hypothyroidism”, “hyperthyroidism”, “adrenal insufficiency”, “type 1 diabetes mellitus”, “autoimmune genitourinary disease”, “(interstitial) nephritis”, “renal failure”, “autoimmune ophthalmologic disease”, “choroidal neovascularization”, “Grave’s ophthalmology”, “optic neuropathy”, “Voght-Koyanagi-Harada syndrome”, “autoimmune systemic diseases”, “sarcoidosis” or

“systemic lupus erythematosus”. Search terms used for the discussion include “*susceptible or *risk loci AND large effect size”, “prophylactic treatment AND checkpoint inhibition”, “polymorphisms *PD-1 or *CTLA-4 AND autoimmune disease”, “improve tolerability checkpoint inhibition”, “lymphocyte count AND checkpoint inhibition” and “immune checkpoint inhibition drug targets”.

Supplemental Table 1. Susceptible loci for autoimmune neuropathies

Gene	NCBI dbSNP accession No.	Associated with	Function	Reference
MMP-9		GBS	Breakdown of extracellular matrix	(93)
TNF-α		GBS	Proinflammatory cytokine	(93)
FcγRIIa (CD32a)		GBS	Low-affinity Fc receptor	(94)
FcγRIIIa (CD16)		GBS	Fc receptor expressed on natural killer, macrophages, and γδ T-cells	(94)
HLA-Aw30, HLA-B8, HLA-Dw3, HLA-DR2, HLA-DRB1*13		CIPD	Cell-surface proteins displaying proteins/antigens	(96, 97, 99, 100)
FCγRIIb		CIPD	Fcγ receptor that has an inhibitory function.	(101)
SH2D2A		CIPD	T-cell-specific adapter protein involved in the control of T-cell activation	(102)
5' RET	rs741763, rs2505997	Enteric neuropathy (HSCR)	Transmembrane receptor tyrosine kinase	(106, 107)
RET intron	rs2435365, rs2435364, rs2435362, rs2435357, rs752975, rs2505535	Enteric neuropathy (HSCR)	Transmembrane receptor tyrosine kinase	(106, 107)
RET protein-coding region	rs1800858, rs3026750, rs1800861, rs2742237, rs2742239, rs2075912	Enteric neuropathy (HSCR)	Transmembrane receptor tyrosine kinase	(106, 107)
GALNACT-2	rs4948705, rs1864393, rs2435337	Enteric neuropathy (HSCR)	Protein glycosylation	(106, 107)
RASGEF1A	rs1254958, rs1254965	Enteric neuropathy (HSCR)	Cell migration	(106, 107)
HLA-DQB1*05:03, HLA-DQB1*06:01, HLA-DQA1*01:03, HLA-DQB1*03:01, HLA-DQB1*03:04	HLA-DQB1*05:03/06:01 (RR=2.44, p=2.17E-18) HLA-DQA1*01:03/03:01 (RR= 1.68, p=2.37E-12)	Enteric neuropathy (esophageal achalasia)	Antigen processing and binding	(108)

	HLA-DQB1*03:01/03:04 (RR= 1.47, p=1.20E-9)			
LTA-α and TNF-α	rs1799724 (OR=1.41, p=1.17E-4)	Enteric neuropathy (esophageal achalasia)	Cytotoxic cytokine and proinflammatory cytokine	(109)
VIPR1	rs437876	Enteric neuropathy (esophageal achalasia)	Activate adenylyl cyclase / transducers of vasoactive intestinal peptide signals to a subset of human T-cells	(110)
IL-10	rs100896 (OR=0.790, p=0.030)	Enteric neuropathy (esophageal achalasia)	Inhibit production other cytokines; IFN-γ, IL-2, IL-3, TNF and GM-CSF	(111)
IL-23R	rs11209026 (OR=1.46, p=0.036)	Enteric neuropathy (esophageal achalasia)	Activates the Jak-Stat signaling cascade	(112)
RAD21	rs72105712	Enteric neuropathy (CIPO)	Double-strand-break repair protein	(113)
SGOL1	rs199815268	Enteric neuropathy (CIPO)	Chromosome cohesion during mitosis	(114)
MTTL1		Enteric neuropathy (CIPO)	mitochondrially encoded tRNA leucine (UUA/G)	(115)
TYMP		Enteric neuropathy (CIPO)	Thymidine phosphorylase	(116)
CTLA-4	rs231770 (OR=1.37, p=3.98E-8), rs733618 (OR =1.95, p<0.0001)	MG	Inhibitory receptor acting as a major negative regulator of T-cell responses	(120, 121)
HLA-DQA1	rs9271871 (OR=2.31, p=1.08E-8)	MG	Antigen processing and binding	(120)
TNFRSF11A	rs4263037 (OR=1.41, p=1.6E-9)	MG	Cytokine binding resulting in NF-κβ activation	(120)
CHRNA1	rs16862847 (OR =1.9, p=0.0024), rs2229957 (OR=1.70m p=0.0083)	MG	Acetyl choline receptor	(121)

AIRE	rs3761389 (OR = 1.22, p=0.041)	MG	Autoimmune regulator	(121)

Abbreviations: GBS, Guillian Barré syndrome. CIPD, chronic immune demyelinating polyneuropathy. MG, myasthenia gravis. MMP-9, matric metallopeptidase 9. TNF-α, tumor necrosis factor alpha. HLA, human leukocyte antigen. SH2D2A, SH2 domain containing 2A. RET, ret proto-oncogene. GALNACT-2, polypeptide N-acetylgalactosaminyltransferase 2. RASGEF1A, RasGEF domain family member 1A. LTA-α, lymphotoxin alpha. VIPR1, vasoactive intestinal peptide receptor 1. IL-10, interleukin 10. IL-23R, interleuking receptor 23. RAD21, RAD21 cohesin complex component. SGOL1, shugoshin like 1. MTTL1, mitochondrially encoded tRNA leucine 1 (UUA/G). TYMP, thymidine phosphorylase. CTLA-4, cytotoxic T-lymphocyte associated protein 4. TNFRSF11A, TNF receptor superfamily member 11a. CHRNA1, cholinergic receptor nicotinic alpha 1 subunit. AIRE, autoimmune regulator.

Supplemental Table 2. Susceptible loci for autoimmune (cardio-) myopathies and skeletal disease

Gene	NCBI dbSNP accession No.	Associated with	Function	Reference
MMEL1	rs4648562 (OR=0.87, p=6.6E-9)	RA	Pain perception, arterial pressure regulation, phosphate metabolism and homeostasis	(127)
PTPN22	rs2476601 (OR=1.78, p=7.5E-77)	RA	Regulating CBL function in the T-cell receptor signaling pathway	(127)
IL-6R	rs2228145 (OR=0.90, p=1.3E-8)	RA	Receptor for the potent pleiotropic cytokine IL-6	(127)
DNASEIL3	rs35677470 (OR=1.19, p=1.7E-7)	RA	Hydrolyzes DNA and mediates the breakdown of DNA during apoptosis	(127)
CD5	rs2229177 (OR=1.09, p=3.4E-8)	RA	Receptor to regulate T-cell proliferation	(127)
ICAM-3	rs7258015 (OR=1.11, p=2.71E-5)	RA	Adhesion and signaling molecule	(127)

TYK2	rs34536443 (OR=0.62, p=2.3E-14)	RA	Promulgate cytokine signals	(127)
SLCO1B1	rs4149056 (OR=4.4, p=3E-9)	Autoimmune myopathies	Encoding protein mediates the hepatic uptake of various drugs	(130)
HLA-DR4, HLA-DR12, HLA-DR15, HLA-DPB*06:01	*HLA-DR4* (OR=1.87, p=0.02), *HLA-DR12* (12.5% patients, 2.8% controls), *HLA-DR15* (21.8% patients, 19.9% controls)	Autoimmune myocarditis	Cell-surface proteins displaying proteins/antigens	(133-135)

Abbreviations: OR, odds ratio. MMEL1, membrane metalloendopeptidase like 1. PTPN22, protein tyrosine phosphatase, non-receptor type 22. IL-6R, interleukin 6 receptor. DNASEIL3, *deoxyribonuclease 1 like 3*. ICAM-3, intercellular adhesion molecule 3. TYK2, tyrosine kinase 2. SLCO1B1, solute carrier organic anion transporter family member 1B1. HLA, human leukocyte antigen. RA, rheumatoid arthritis.

Supplemental Table 3. Susceptible loci for endocrinopathies

Gene	NCBI dbSNP accession No.	Associated with	Function	Reference
PTPN22	rs2476601 (AITD & autoimmune adrenalitis), rs6679677 (T1D) (OR=1.88, p=4.76E-24)	AITD, autoimmune adrenalitis, T1D (CRO RA SLE AA VIT)	Regulating CBL function in the T-cell receptor signaling pathway	(147, 149, 151)
CTLA-4	rs11571297 (AITD) rs3087243 (T1D) (OR=0.85, p=8.64E-5)	AITD, autoimmune adrenalitis, T1D	Inhibitory receptor acting as a major negative regulator of T-cell responses	(147, 149, 151)
TSHR	rs2300519	AITD	Receptor for thyrothropin and thyrostimulin	(147)

MMEL1	rs2843403 (OR= 0.97, p=0.696)	AITD (MS)	Pain perception, arterial pressure regulation, phosphate metabolism and homeostasis	(147)
LPP	rs13093110 (OR=1.20, p=7.09E-3)	AITD	Involved in cell-cell adhesion and cell motility	(147)
BACH2	rs72928038 (OR=1.30, p=1.36E-3)	AITD (MS RA T1D)	Involved NF-κβ signaling	(147)
IL-2RA	rs706779 (AITD), rs12251307 (T1D) (OR=0.75, p=3.96E-5), rs11256448 (T1D) (OR=1.57E-3)	AITD, T1D (VIT)	Receptor is involved in the regulation of immune tolerance by controlling regulatory T-cells	(147, 151)
HLA-DR3, HLA-DQ2, HLA-DR4, HLA-DQ8		Autoimmune adrenalitis	Cell-surface proteins displaying proteins/antigens	(149)
MICA		Autoimmune adrenalitis	Encodes the highly polymorphic MHC class I chain-related protein A	(149)
CIITA	rs3087456, rs8048002	Autoimmune adrenalitis	Positive regulator of MHC class II gene transcription	(149)
CLEC16A	rs12917716 (autoimmune adrenalitis), rs12708716 (T1D) (OR=0.79, p=9.69E-8)	Autoimmune adrenalitis	Encodes a member of the C-type lectin domain containing family	(149)
CYP27B1		Autoimmune adrenalitis	Involved in drug metabolism and synthesis of cholesterol, steroids and other lipids	(149)

PD-L1	rs1411262	Autoimmune adrenalitis	Interaction with its receptor inhibits T-cell activation and cytokine production	(149)
IFIH1	rs3747517 (OR=0.87, p=4.21E-3)	T1D (PSO SLE UC IBD VIT)	Involved in alteration of RNA secondary structure	(151)
IGF2	rs3741208 (OR=1.25, p=2.28E-7)	T1D	Involved in development and growth	(151)
C12orf30	rs17696736 (OR=1.38, p=1.02E-13)	T1D	Part of complex that acetylates methionine residues	(151)
ERBB3	rs2292239 (OR=1.30, p=2.26E-9)	T1D (AA)	Encodes a member of the EGFR family of receptor tyrosine kinases.	(151)
PTPN2	rs2542151 (OR=1.35, p=7.39E-8), rs8087237 (OR=0.87, p=1.34E-3)	T1D (CEL CRO UC IBD)	Encodes a member of the protein tyrosine phosphatase	(151)
HLA-DQA1	rs9272346 (OR=0.28, p=1.04E-126)	T1D	Cell-surface proteins displaying proteins/antigens	(151)

Abbreviations: OR, odds ratio. PTPN22, protein tyrosine phosphatase, non-receptor type 22. CTLA-4, cytotoxic T-lymphocyte associated protein 4. TSHR, thyroid stimulating hormone receptor. MMEL1, membrane metalloendopeptidase like 1. LPP, LIM domain containing preferred translocation partner in lipoma. BACH2, BTB domain and CNC homolog 2. IL-2RA, interleukin 2 receptor subunit alpha. HLA, human leukocyte antigen. MICA, MHC class I polypeptide-related sequence A. CIITA, class II major histocompatibility complex transactivator. CLEC16A, C-type lectin domain containing 16A. CUP27B1, cytochrome P450 family 27 subfamily B member 1. PD-L1, programmed cell death 1 ligand 1. IFIH1, interferon induced with helicase C domain 1. IGF2, insulin like growth factor 2. ERBB3, erb-b2 receptor tyrosine kinase 3. PTPN2, protein tyrosine phosphatase, non-receptor type 2. AITD, autoimmune thyroid disease. T1D, Type 1 diabetes mellitus. CRO, Crohn's disease. RA, rheumatoid arthritis. SLE, Systemic Lupus Erythematosus. AA, alopecia areata. VIT, vitiligo. MS, multiple sclerosis. PSO, psoriasis. UC, ulcerative colitis. IBD, inflammatory bowel disease. CEL, celiac disease.

Supplemental Table 4. **Susceptible loci for gastrointestinal diseases**

Gene	NCBI dbSNP accession No.	Associated with	Function	Reference
LRRK2	rs7307562 (Prob. 0.999)	CD	A member of the leucine-rich kinase family	(152)
NOD2	rs2066844 (Prob. 0.999), rs2066845 (Prob. 0.999), rs5743271 (Prob. 0.993), rs5743293 (Prob. 0.999), rs72796367 (Prob. 0.983)	CD	Plays a role in the immune response to LPS	(152)
HNF4A	rs6017342 (Prob. 0.999)	IBD, UC	Nuclear transcription factor which binds DNA as a homodimer	(152)
IL-2RA	rs61839660 (Prob. 0.999)	CD	Receptor is involved in the regulation of immune tolerance by controlling regulatory T-cells	(152)
RTEL1-TNFRSF6B	rs6062496 (Prob. 0.996)	IBD	Locus that represents naturally occurring read-through transcription between the neighboring RTEL1 and TNFRSF6B genes	(152)
CARD9	rs141992399 (Prob. 0.995)	IBD	A protein interaction domain known to participate in activation or suppression of CARD containing members of the caspase family	(152)
IFIH1	rs35667974 (Prob. 0.994)	UC	Involved in alteration of RNA secondary structure	(152)
IKZF1	rs74465132 (Prob. 0.994)	IBD	Regulator of T-cell activation	(152)
GPR35	rs4676408 (Prob. 0.994)	UC	Receptor for kynurenic acid, an intermediate in the tryptophan metabolic pathway	(152)

NKX2-3	rs10748781 (Prob. 0.990)	IBD	Encodes a homeodomain-containing transcription factor	(152)
SMAD3	rs35874463 (Prob. 0.989)	IBD	Signal transducers and transcriptional modulators that mediate multiple signaling pathways	(152)
JAK2	rs1887428 (Prob. 0.974)	IBD	Involved in a specific subset of cytokine receptor signaling pathways	(152)
IL-23R	rs41313262 (Prob. 0.973)	CD	Activates the Jak-Stat signaling cascade	(152)
PRDM1	rs28701841 (Prob. 0.971)	CD	Mediates a transcriptional program in various innate and adaptive immune tissue-resident lymphocyte T-cell types	(152)
HLA-A1, HLA-B8, ***HLA-DRB3*01:01, HLA-DRB1*03:01, HLA-DQA1*05:01, HLA-DQB1*02:01, HLA-DRB1*04:01***	*HLA-A1* (RR=2.67, p=0.021), *HLA-B8* (RR=4.09, p=1.5E-4), *HLA-DRB3*01:01* (RR=3.33, p=8.3E-4), *HLA-DRB1*03:01* (RR=4.58, p=3E-5), *HLA-DQA1*05:01* (RR=2.42, p=0.0341), *HLA-DQB1*02:01* (RR=3.18, p=1.43E-3), *HLA-DRB1*04:01* (RR=5.97, p=1.32E-4),	AIH (N Euro)	Cell-surface proteins displaying proteins/antigens	(156)
HLA-DR4*04:04, ***HLA-DRB*04:05***	*HLA-DR4*04:04* (OR=4.70, p<5.9E-10), *HLA-DRB*04:05* (OR=4.97, p<2.9E-8)	AIH (Jap, Cent Am, China)	Cell-surface proteins displaying proteins/antigens	(157)
HLA-DRB1*13:01, HLA-DQB1*06	*HLA-DRB1*13:01* (70% patients vs 26% controls, p<1E-5, *HLA-DQB1*06* (70% patients vs 30% controls, p=1E-4)	AIH (Lat Am)	Cell-surface proteins displaying proteins/antigens	(158)
HLA-DRB1*01, HLA-DRB1*14	*HLA-DRB1*01* (25% patients vs 2% controls), *HLA-DRB1*14* (30% patients vs 12% controls)	AIH (W. India)	Cell-surface proteins displaying proteins/antigens	(159)
CARD10	rs6000782 (OR=1.7, p=1.8E-5)	AIH	Encodes for caspase recruitment domain	(160)

SH2B3	rs3184504 (OR=1.4, p=5E-7)	AIH	Negative regulator of T-cell activation, tumor necrosis factor, and Janus kinase 2 and 3 signaling	(160)

Abbreviations: Prob., posterior probability for being a causal variant. RR, relative risk. OR, odds ratio. LRRK2, leucine rich repeat kinase 2. NOD2, nucleotide binding oligomerization domain containing 2. HNF4A, hepatocyte nuclear factor 4 alpha. IL-2RA, interleukin 2 receptor subunit alpha. RTEL1, regulator of telomere elongation helicase 1. TNFRSF6B, TNF receptor superfamily member 6b. CARD9, caspase recruitment domain family member 9. IFIH1, interferon induced with helicase C domain 1. IKZF1, IKAROS family zinc finger 1. GPR35, G protein-coupled receptor 35. NKX2-3, NK2 homeobox 3. SMAD3, SMAD family member 3. JAK2, Janus kinase 2. IL-23R, interleukin 23 receptor. PRDM1, PR/SET domain 1. HLA, human leukocyte antigen. CARD10, caspase recruitment domain family member 10. SH2B3, SH2B adaptor protein 3. CD, Crohn's disease. IBD, inflammatory bowel disease. UC, ulcerative colitis. AIH, autoimmune hepatits.

Supplemental Table 5. Susceptible loci for dermatologic diseases

Gene	NCBI dbSNP accession No.	Associated with	Function	Reference
TYR	rs4409785 (OR=1.36, p=2.26E-10), rs11021232 (OR=1.35, p=9.20E-10)	VIT	Encodes tyrosinase, a key enzyme of melanin biosynthesis	(163, 164)
OCA2-HERC2	rs1129038 (OR=1.26, p=3.23E-7), rs12913832 (OR=1.26, p=3.29E-7)	VIT	Melanosomal membrane transporter and its down regulator	(163, 164)
MC1R	rs4785587 (OR=0.80, p=1.08E-8), rs9926296 (OR=0.77, p4.34E-11)	VIT	Encodes melanocortin receptor, a regulator of melanogenesis	(163, 164)
IFIH1	rs2111485 (VIT) (OR=0.77, p=1.67E-10), rs1990760 (VIT) (OR=0.78, p=2E-10), rs2111485 (PSO) (OR=1.14, p=7.9E-4)	VIT & PSO (SLE T1D UC IBD)	Involved in antiviral innate response	(60, 163, 164)
CD80	rs59374417 (OR=1.33, p=3.97E-7), rs4330287 (OR=1.33, p=3.97E-7)	VIT	Surface protein on activated B-cells, monocytes and dendritic cells for co-stimulation T-cells (ligand CTLA-4)	(163, 164)

CLNK	rs11940117 (OR=1.24, p=9E-8), rs16872571 (OR=1.23, p=2.5E-7)	VIT	Mast cell immunoreceptor signal transducer	(163, 164)
BACH2	rs3757247 (OR=1.18, p=2.14E-5)	VIT (T1D)	Transcriptional repressor of B-cells	(163, 164)
SLA	rs853308 (OR=1.21, p=1.14E-6)	VIT	Regulator of antigen receptor signaling	(163, 164)
CASP-7	rs3814231 (OR=0.81, p=1.20E-5), rs4353229(OR=0.84, p=1.32E-4)	VIT	Role apoptosis and inflammation	(163, 164)
CD44	rs736374 (OR=1.25, p=3.06E-8), rs10768122 (OR=1.24, p=6.13E-8)	VIT	Role in T-cell development	(163, 164)
IKZF4	rs1701704 (OR=1.28, p=1.53E-9), rs2456973 (OR=1.28, p=1.22E-9)	VIT (T1D AA)	Regulator of T-cell activation	(163, 164)
SH2B3	rs3184504 (OR=0.76, p=1.32E-11), rs4766578 (OR=0.76, p=9.10E-12)	VIT (CEL CRO JIA PBC RA T1D PSC)	Regulates development B- and T-cells	(163, 164)
TICAM1	rs6510827 (OR=1.20, p=6.98E-6)	VIT	Mediates innate immune responses to viral pathogens	(163, 164)

TOB2	rs4822024 (OR=0.76, p=1.02E-7), rs79008 (OR=0.78, p=1.44E-6)	VIT	Regulator of cell cycle progression involved in T-cell tolerance	(163, 164)
TNF-α		Oral lichen planus (in Northern-Italian-population)	Pro-inflammatory cytokine	(165)
IFN-γ		Oral lichen planus (in Northern-Italian-population)	Cytokine that is a member of the type II interferon class	(165)
HLA-B*15:02, HLA-A*31:01, HLA-B*58:01		Drug-induced SJS and TEN	Cell-surface proteins displaying proteins/antigens	(56, 58, 59, 167)
ERAP2	rs2910686 (OR=1.12, p=2.3E-5)	PSO (CRO, AS)	Trimming antigenic epitopes for presentation by MHC class I	(60)
IL-12B	rs4379175 (OR=1.31, p=4.8E-20)	PSO (CRO)	Cytokine that acts on T and natural killer cells	(60)
MICA	rs13437088 (O=1.32, p=2.8E-17)	PSO (AS)	Encodes for protein that functions as a stress-induced antigen	(60)
TYK2	rs12720356 (OR=1.25, p=9.7E-6)	PSO (CRO, T1D)	Promulgate cytokine signals	(60)

Abbreviations: OR, odds ratio. TYR, tyrosinase. OCA2, OCA2 melanosomal transmembrane protein. HERC2, HECT and RLD domain containing E3 ubiquitin protein ligase 2. MC1R, melanocortin 1 receptor. IFIH1, interferon induced with helicase C domain 1. CLNK, cytokine dependent hematopoietic cell linker. BACH2, BTB domain and CNC

homolog 2. SLA, Src like adaptor. CASP-7, caspase-7. IKZF4, IKAROS family zinc finger 4. SH2B3, SH2B adaptor protein 3. TICAM1, toll-like receptor adaptor molecule 1. TOB2, transducer of ERBB2, 2. TNF-α, tumor necrosis factor alpha. IFN-γ, interferon gamma. HLA, human leukocyte antigen. ERAP2, endoplasmic reticulum aminopeptidase 2. IL-12B, interleukin 12B. MICA, MHC class I polypeptide-related sequence A. TYK2, tyrosine kinase 2. VIT, vitiligo. PSO, psoriasis. SLE, systemic lupus erythematosus. T1D, type 1 diabetes mellitus. UC, ulcerative colitis. IBD, inflammatory bowel disease. AA, alopecia areata. CEL, celiacl disease. CRO, Crohn's disease. JIA, juvenile idiopathic arthritis. PBC, primary biliary cirrhosis. RA, rheumatoid arthritis. PSC, primary sclerosing cholangitis. SJS, Stevens-Johnson syndrome. TEN, toxic epidermal necrolysis. AS, ankylosing spondylitis. MS, multiple sclerosis.

Supplemental Table 6. Susceptible loci for respiratory diseases

Gene	NCBI dbSNP accession No.	Associated with	Function	Reference
SP-C		familial ILD	Reduces surface tension at air-liquid interface of the lungs	(175, 176)
Aire		ILD in mice	Autoimmune regulator	(177)
TERT	rs2736100 (OR=1.29, p=2E-2)	ILD and IIP	Maintains telomere ends by addition of the telomere repeat TTAGGG	(178-180)
MUC5B	rs35705950 (OR=2.22, p=7E-10)	ILD and IIP	Contributor to the lubricating and viscoelastic properties of whole saliva, normal lung mucus and cervical mucus	(178-180)

Abbreviations: OR, odds ratio. SP-C, surfactant protein C. Aire, autoimmune regulator. TERT, telomerase reverse transcriptase. MUC5B, mucin 5B, oligomeric mucus/gel-forming. ILD, interstitial lung disease. IIP, Idiopathic interstitial pneumonia.

Supplemental Table 7. Susceptible loci for hematologic conditions

Gene	NCBI dbSNP accession No.	Associated with	Function	Reference

FOXP3	rs122467170	Autoimmune neutropenia	Role in the maintenance of self-tolerance	(183)
HLA-DRB*16, HLA-DQB1*05:02	*HLA-DRB*16* (OR=10.2), *HLA-DQB1*0502* (OR=2.5)	AHA	Cell-surface proteins displaying proteins/antigens	(188)
CTLA-4	(OR=2.17)	AHA	Inhibitory receptor acting as a major negative regulator of T-cell responses	(188)
TNF-α	rs1800629 (OR=2.23, p=0.006)	Aplastic anemia	Pro-inflammatory cytokine	(190)
HLA-A*02:01, HLA-A*02:06, HLA-A*31:01, HLA-B*40:02	*HLA-A*02:01* (OR=1.87, p=2.5E-6), *HLA-A*02:06* (OR=2.22, p<1E-7), *HLA-A*31:01* (OR=1.37, p=0.048), *HLA-B*40:02* (OR=1.95, p=1.8E-6)	Aplastic anemia	Cell-surface proteins displaying proteins/antigens	(191)

Abbreviations: OR, odds ratio. FOXP3, forkhead box P3. HLA, human leukocyte antigen. CTLA-4, cytotoxic T-lymphocyte associated protein 4. TNF-α, tumor necrosis factor alpha. AHA, acquired hemophilia A.

Supplemental Table 8. Susceptible loci for ophthalmologic diseases

Gene	NCBI dbSNP accession No.	Associated with	Function	Reference
CFH	rs380390, rs1329428	Age-related macular degeneration	Regulation of complement activation	(195)
IL-1A	rs1800587	GO	Inflammatory cytokine	(196)
HLA-DRB1*04:05	rs3021304	VKH syndrome (in Han Chinese)	Cell-surface proteins displaying proteins/antigens	(200)

IL-23R	rs117633859	VKH syndrome (in Han Chinese)	Activates the Jak-Stat signaling cascade	(200)
ADO-ZNF365-EGR2	rs442309	VKH syndrome (in Han Chinese)	Three different genes encoding for zinc finger proteins and thiol dioxygenase	(200)

Abbreviations: CFH, complement factor H. IL-1A, interleukin-1A. HLA, human leukocyte antigen. IL-23R, interleukin-23 receptor. ADO, 2-Aminoethanethiol Dioxygenase. ZNF365, zinc finger protein 365. EGR2, early growth response 2. GO, Grave's ophthalmology. VKH, Vogt-Koyanagi-Harada

Supplemental Table 9. **Susceptible loci for systemic autoimmune diseases**

Gene	NCBI dbSNP accession No.	Associated with	Function	Reference
BTNL2	rs2076530, rs9268402, rs2076533	Sarcoidosis	A member of the immunoglobulin superfamily, a costimulatory molecule involved in T-cell activation (B7-1)	(209)
ANXA11	rs2789679, rs7091565	Sarcoidosis	Essential functions in several biological pathways, including apoptosis and proliferation	(208)
HLA-DRA, HLA-DRB5, HLA-DRB1	rs7194, HLA-DRA; rs9268853, HLA-DRB5; rs615672, HLA-DRB1	Sarcoidosis	Cell-surface proteins displaying proteins/antigens	(208, 209)

Abbreviations: BTNL2, butyrophilin-like 2. ANXA11, annexin A11. HLA, human leukocyte antigen.

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