lumi
health

Extended Gene List
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Gene & condition list

The ***Lumi Health*** **Extended Test** provides people with information about their chance of having children with severe genetic conditions. The *Lumi Health* Extended carrier screen test was developed based on experience and outcomes of **Mackenzie's Mission**.

Genes and conditions screened

Lumi Health Extended Test includes over 629 genes associated with hundreds of conditions[1]. This gene panel is reviewed periodically by a committee of experts in genomics and screening. Consumer groups such as the Genetic Support Network of Victoria have input into considerations about which genes are screened.

The gene list is managed via PanelApp (https://panelapp.agha.umccr.org/panels/4225/), a publicly accessible platform used by the scientific community to enable gene panels to be shared and evaluated.

For a gene to be included in the *Lumi Health* Extended Test gene panel, the following criteria must be met:

- The gene is known to cause a genetic condition
- Screening the gene is technically possible with high sensitivity using currently available technology
- The condition associated with the gene affects children
- The condition associated with the gene has a serious impact on a person's quality of life and/or is life-limiting

For many of the genes, there is no treatment available for the associated conditions or the treatment is very burdensome for the child and their family. For some genes, early diagnosis and treatment of the associated condition can make a difference.

Types of conditions included

The conditions associated with the genes screened in the *Lumi Health* Extended Test vary in the way they affect people and can involve one or many different parts of the body. Impacts can include:

Shortened life expectancy either causing death in childhood, or with symptoms in childhood and early death in adulthood.

Intellectual disability limiting a person's ability to learn and develop independence. In some conditions this can be severe, for example the child with the condition may never learn to walk or talk. In other conditions the child may be able to do many things for themself, whilst also needing extra help with daily activities and support throughout their life.

[1] Some genetic conditions can be caused by changes in more than one gene.

Physical conditions which affect the function of the body and may affect one or more organ systems. Examples include conditions that impact: the development and function of the heart, the function of the lungs, or differences in how limbs develop. In some cases, treatment options exist. In other cases, there is no treatment available.

Neurological and muscular conditions which can be due to a problem with the brain structure, problems with the way the brain sends signals through the spinal cord and nerves to the body, or because the muscles themselves are weak. Sometimes these conditions can get worse over time

Important information about analysis and reporting of results

In addition to knowing what genes are being screened in the Lumi Health Extended Test, it is important to understand how the results are being analysed and reported. This screening is designed to provide genetic information that is relevant and useful for reproductive decision-making, and to minimise uncertain and unclear information.

It is important to be aware that, although a gene may be included on the Lumi Health Extended Test gene list, there are situations where particular genetic changes may not be analysed or reported.

A focus on severe conditions that occur in childhood

Some genetic conditions vary in how much they affect people. Knowing about a chance of having children with a mild form of a genetic condition often does not alter parents' reproductive plans and can cause confusion and distress. The focus of the Lumi Health Extended Test is to provide information about the chance of having children with severe genetic conditions. If a particular change in a gene is only associated with a mild form of the condition, this will not be reported.

A 'reproductive couple' screen

A reproductive couple screening approach is taken for the Lumi Health Extended Test , meaning both genetic parents[2] of the pregnancy or planned pregnancy are screened at the same time. We are all genetic carriers for inherited conditions, however, many of the severe genetic conditions that occur in childhood are caused by both the biological mother and the biological father being carriers for the same autosomal recessive condition, or the biological mother being a carrier for an X-linked condition. Because of the very large number of genes screened, screening both genetic parents at the same time and issuing a combined result provides the most useful information for that couple.

If only one partner is a genetic carrier for an autosomal recessive condition/s, this will not be reported. This is because together, the couple will have a low chance of having children with the condition. It is not practical

[2] Families can be comprised of a broad range of structures, and parents may or may not have genetic links with their child (for example, if gamete or embryo donors are used). With respect to reproductive genetic carrier screening, there are two 'genetic parents' (of male and female sex) for the prospective or current pregnancy who can be considered the 'reproductive couple'.

to issue individual results for every person screened, and the results are most meaningful when combined. If, in the future, either person has a new partner, that new reproductive couple should consider screening, as the results for the original couple are not relevant to the new couple.

A screening approach

There are many different types of gene changes that can cause genetic conditions. It is important to understand that, even with a 'low chance' result, there remains a small chance of a reproductive couple having children with a genetic condition that was screened. This type of testing is referred to as 'screening' because the technology used will detect many, but not all, genetic changes causing these conditions. Screening may not cover all genes associated with a particular genetic condition. This may be because the gene is associated with a mild form of the condition, or there are technical challenges in screening the gene.

For all genes except FMR1 and SMN1, massively parallel sequencing is used. Massively parallel sequencing will detect most but not all genetic changes in each gene screened. There are some types of genetic changes that are not able to be detected using this approach. This includes larger sections of extra or missing genetic material (called copy number variants,) or rearrangements. For the FMR1 and SMN1 genes, targeted tests are used. For FMR1, screening may also include AGG interruption analysis if the female carries a permutation between 55 and 69 CGG repeats.

Screening results are based on current knowledge

Knowledge about our genes is changing every day. The Lumi Health Extended Test results are analysed and interpreted by experienced laboratory scientists. Their interpretation of the genomic variants will be based on currently available information. So far, detailed genomic studies have not been done in people from all the ethnic backgrounds found in the Australian population. This can make it more challenging to interpret some results. For people from backgrounds for which there is less information, there may be a higher chance that reproductive couples who have an increased chance of having children with a genetic condition will not be identified.

When there is a family history of a genetic condition

While genetic carrier screening is relevant to everyone, there will be some people who have a genetic condition themselves, or who have a relative/s with a genetic condition. It is important for people with a family history of a genetic condition to speak to a member of our genetic counselling team, to determine whether the Lumi Health Extended Test is right for them.

Even if the gene causing the condition in their family is on the Lumi Health Extended Test gene list, it is important to clarify whether the test can detect the genetic change(s) present in that family.

Condition	Genes
Syndromes with intellectual disability	
Multiple congenital abnormalities with intellectual disability	
Achalasia-addisonianism-alacrimia syndrome	AAAS
Arthrogryposis, intellectual disability, and seizure disorder	SLC35A3
3MC syndrome	COLEC11, MASP1
Bardet-Biedl syndrome	ARL6, BBS1, BBS10, BBS12, BBS2, BBS4, BBS5, BBS7, BBS9, LZTFL1, MKKS, MKS1, SDCCAG8, TTC8
Behr syndrome	OPA1
Bloom syndrome	BLM
Partington syndrome	ARX
COACH syndrome	CC2D2A, RPGRIP1L, TMEM67
Cockayne syndrome	ERCC4, ERCC5, ERCC6, ERCC8
Cohen syndrome	VPS13B
Cerebro Oculo Facio Skeletal syndrome (COFS)	ERCC2, ERCC6
Coffin-Lowry syndrome	RPS6KA3
Cowchock syndrome	AIFM1
De Sanctis-Cacchione syndrome	ERCC6
Donnai-Barrow syndrome	LRP2
DOOR syndrome	TBC1D24
XFE progeroid syndrome	ERCC4
Desmosterolosis	DHCR24
Dyggve-Melchior-Clausen disease	DYM
Fragile X syndrome	FMR1
Frontometaphyseal dysplasia	FLNA
Galloway-Mowat syndrome	OSGEP
Gillespie syndrome	ITPR1
Hypoparathyroidism-retardation-dysmorphism syndrome	TBCE
Hypotonia, infantile, with psychomotor retardation and characteristic facies	NALCN
Jawad syndrome	RBBP8
Johanson-Blizzard syndrome	UBR1
Infantile liver failure syndrome	LARS1
Intellectual developmental disorder with cardiac arrhythmia	GNB5
Lujan-Fryns syndrome	MED12

Ohdo syndrome	MED12
Opitz-Kaveggia syndrome	MED12
Opitz GBBB syndrome	MID1
Nijmegen breakage syndrome	NBN
Neuropathy, hereditary sensory and autonomic, type IX, with developmental delay	TECPR2
Multiple congenital anomalies-hypotonia-seizures syndrome	PIGN, PIGT
Renpenning syndrome	PQBP1
Salt and pepper developmental regression syndrome	ST3GAL5
Seckel syndrome	ATR, CENPJ, CEP152, RBBP8
Smith-Lemli-Opitz syndrome	DHCR7
LIG4 syndrome	LIG4
Chudley-McCullough syndrome	GPSM2
Martsolf syndrome	RAB3GAP2
Pierson syndrome	LAMB2
Hennekam lymphangiectasia-lymphedema syndrome	CCBE1, FAT4
Perlman syndrome	DIS3L2
Filippi syndrome	CKAP2L
Fraser syndrome	FRAS1, FREM2
Orofaciodigital syndrome	CPLANE1, SERPINH1, TCTN3
Roberts syndrome	ESCO2
SC phocomelia syndrome	ESCO2
Warburg micro syndrome	RAB18, RAB3GAP1, RAB3GAP2
Woodhouse-Sakati syndrome	DCAF17
Van Maldergem syndrome	FAT4
Warsaw breakage syndrome	DDX11
You-Hoover-Fong syndrome	TELO2
X-linked syndromic intellectual disability	
Turner type	HUWE1
Claes-Jensen type	KDM5C
Siderius type	PHF8
Type 14	UPF3B
Raymond type	ZDHHC9
Intellectual disability, truncal obesity, retinal dystrophy, and micropenis	INPP5E

Intellectual disability, X-linked, with cerebellar hypoplasia and distinctive facial appearance	OPHN1
Syndromic brain malformations	
MASA syndrome	L1CAM
CRASH syndrome	L1CAM
Agenesis of the corpus callosum with peripheral neuropathy (Andermann syndrome)	SLC12A6
Acrocallosal syndrome	KIF7
Proud syndrome	ARX
Vici syndrome	EPG5
Syndromic skin conditions with intellectual disability	
Cerebral dysgenesis, neuropathy, ichthyosis, and palmoplantar keratoderma syndrome	SNAP29
Adams-Oliver syndrome	DOCK6
Syndromic vision conditions with intellectual disability	
Peter's plus syndrome	B3GLCT
Knobloch syndrome	COL18A1
Lowe syndrome	OCRL
Norrie disease	NDP
Syndromic growth conditions with intellectual disability	
Simpson-Golabi-Behmel syndrome	OFD1, GPC3
Severe, lethal, neonatal syndromes	
Meckel syndrome	CC2D2A, CEP290, MKS1, NPHP3, RPGRIP1L, TMEM216, TMEM231, TMEM67
Fetal akinesia deformation sequence	RAPSN
Lethal congenital contracture syndrome	GLE1
Hydrolethalus syndrome	HYLS1, KIF7
Rigidity and multifocal seizure syndrome, lethal neonatal	BRAT1
Syndromes without intellectual disability	
Multiple pterygium syndrome	
Escobar syndrome	CHRNG
Multiple congenital abnormalities	
McKusick-Kaufman syndrome	MKKS
Werner syndrome	WRN
Syndromic skin and skeletal conditions	
Alstrom syndrome	ALMS1

Haim-Munk syndrome	CTSC
Laryngoonychocutaneous syndrome	LAMA3
Dyskeratosis congenita	DKC1, RTEL1
Papillon-Lefevre syndrome	CTSC
Treacher-Collins syndrome	POLR1C
Schimke immunoosseous dysplasia	SMARCAL1
Syndromic vision and hearing conditions	
Usher syndrome	ADGRV1, CDH23, CLRN1, MYO7A, PCDH15, USH1C, USH1G, USH2A, WHRN
Syndromic vision and renal conditions	
Senior-Loken syndrome	CEP290, NPHP1, SDCCAG8
Mitochondrial conditions	
Conditions affecting multiple body systems	
Combined oxidative phosphorylation deficiency	AARS2, GFM1, MTFMT, NARS2, RMND1, TSFM
Leigh and Leigh-like syndrome	
Mitochondrial complex I deficiency	ACAD9, FOXRED1, NDUFAF2, NDUFAF5, NDUFS6, NDUFS4, NDUFS7, NDUFV1
Leigh syndrome due to cytochrome c oxidase deficiency	COX15
Leigh syndrome, French Canadian type	LRPPRC
Other mitochondrial conditions	
Mitochondrial complex III deficiency	BCS1L
Mitochondrial complex IV deficiency	SURF1, PET100
Mitochondrial DNA depletion syndrome	DGUOK, MPV17, TK2, TWNK, TYMP
Mitochondrial recessive ataxia syndrome (includes SANDO and SCAE)	TWNK
Cardioencephalomyopathy, fatal infantile, due to cytochrome c oxidase deficiency 2	COX15, SCO2
HSD10 disease	HSD17B10
Myopathy, lactic acidosis, and sideroblastic anaemia	PUS1, YARS2
Mitochondrial short-chain enoyl-CoA hydratase 1 deficiency	ECHS1
Lysosomal storage disorders	
Mannosidosis	
Alpha	MAN2B1
Beta	MANBA

Mucopolysaccharidosis	
Mucopolysaccharidosis	GALNS, GNS, GUSB, IDS, IDUA
Type VI (Maroteaux-Lamy)	ARSB
Type IVB (Morquio)	GLB1
Type IIIA (Sanfilippo A)	SGSH
Type IIIB (Sanfilippo B)	NAGLU
Type IIIC (Sanfilippo C)	HGSNAT
Cystinosis	
Atypical nephropathic	CTNS
Nephropathic	CTNS
Late-onset juvenile or adolescent nephropathic	CTNS
Ocular non-nephropathic	CTNS
Other lysosomal storage disorders	
Galactosialidosis	CTSA
Fucosidosis	FUCA1
Glycogen storage disease (Pompe)	GAA
Krabbe disease	GALC, PSAP
Fabry disease	GLA
GM1-gangliosidosis	GLB1
GM2-gangliosidosis	HEXA
Metachromatic leukodystrophy	ARSA, PSAP
Mucolipidosis	GNPTAB, GNPTG, MCOLN1
Tay-Sachs disease	HEXA
Sandhoff disease	HEXB
Chediak-Higashi syndrome	LYST
Aspartylglucosaminuria	AGA
Schindler disease	NAGA
Sialidosis	NEU1
Combined SAP deficiency	PSAP
Sialic acid storage disorder	SLC17A5
Niemann-Pick disease	NPC1, NPC2, SMPD1
Metabolic conditions	
Peroxisome biogenesis disorders	
Including Zellweger syndrome, neonatal adrenoleukodystrophy and infantile Refsum disease	PEX1, PEX10, PEX12, PEX13, PEX16, PEX2, PEX26, PEX5, PEX6, PEX7
Organic acidemias	

Argininosuccinic aciduria	ASL
3-methylglutaconic aciduria	AUH, CLPB, OPA3, SERAC1
D-2-hydroxyglutaric aciduria	D2HGDH
Glutaricaciduria	GCDH
L-2-hydroxyglutaric aciduria	L2HGDH
Methylmalonic aciduria	MMADHC, MMUT
Methylmalonic aciduria and homocystinuria	LMBRD1, MMACHC, MMADHC
Alpha-methylacetoacetic aciduria	ACAT1
Methylmalonic aciduria, vitamin B12-responsive	MMAA, MMAB
Mevalonic aciduria	MVK
Combined D-2- and L-2-hydroxyglutaric aciduria	SLC25A1
Isovaleric acidemia	IVD
Glutaric acidemia	ETFA, ETFB, ETFDH
Other metabolic conditions	
Adenylosuccinase deficiency	ADSL
Arts syndrome	PRPS1
Galactosemia	GALT
Glycogen storage disease	AGL, G6PC, GBE1, PFKM, SLC37A4
Hyperinsulinemic hypoglycemia	ABCC8, HADH, KCNJ11
Hyperoxaluria	AGXT
Succinic semialdehyde dehydrogenase deficiency	ALDH5A1
Fructose intolerance	ALDOB
Congenital disorders of glycosylation	ALG1, ALG3, ALG6, MPI, PGM1, PMM2
Congenital disorder of deglycosylation	NGLY1
Glycine encephalopathy	AMT, GLDC
Argininemia	ARG1
Asparagine synthetase deficiency	ASNS
Canavan disease	ASPA
Citrullinemia	ASS1, SLC25A13
Menkes disease and occipital horn syndrome	ATP7A
Maple syrup urine disease	BCKDHA, BCKDHB, DBT
GRACILE syndrome	BCS1L
Homocystinuria	MMADHC, MTHFR, MTR, MTRR
Lysinuric protein intolerance	SLC7A7
Proteinuria	CLCN5
Prolidase deficiency	PEPD
Hypomagnesemia	TRPM6
Carbamoylphosphate synthetase I deficiency	CPS1

CPT 2 deficiency	CPT1A, CPT2
Metabolic encephalomyopathic crises, recurrent, with rhabdomyolysis, cardiac arrhythmias, and neurodegeneration	TANGO2
Medium-chain acyl-CoA dehydrogenase (MCAD) deficiency	ACADM
Peroxisomal acyl-CoA oxidase deficiency	ACOX1
17-alpha-hydroxylase deficiency	CYP17A1
17,20-lyase deficiency	CYP17A1
Cerebrotendinous xanthomatosis	CYP27A1
Aromatic L-amino acid decarboxylase deficiency	DDC
Dihydrolipoamide dehydrogenase deficiency	DLD
Wolcott-Rallison syndrome	EIF2AK3
Hypophosphatemic rickets	ENPP1
Hyperphosphatasia with intellectual disability syndrome	PGAP2
Ethylmalonic encephalopathy	ETHE1
Tyrosinemia	FAH, HPD, TAT
Fructose-1,6-bisphosphatase deficiency	FBP1
Fumarase deficiency	FH
Cerebral creatine deficiency syndrome	GAMT, GATM, SLC6A8
Gaucher disease	PSAP
Molybdenum cofactor deficiency	MOCS1, MOCS2
Glutathione synthetase deficiency	GSS
3-hydroxyacyl-CoA dehydrogenase deficiency	HADH
LCHAD deficiency	HADHA
Trifunctional protein deficiency	HADHA, HADHB
Hemochromatosis	HAMP, HJV
3-hydroxyisobutryl-CoA hydrolase deficiency	HIBCH
Holocarboxylase synthetase deficiency	HLCS
HMG-CoA lyase deficiency	HMGCL
HMG-CoA synthase-2 deficiency	HMGCS2
Lesch-Nyhan syndrome	HPRT1
D-bifunctional protein deficiency	HSD17B4
Familial hypercholesterolemia	LDLR, LDLRAP1
Cholesteryl ester storage disease	LIPA
Wolman disease	LIPA
Lipoprotein lipase deficiency	LPL
Malonyl-CoA decarboxylase deficiency	MLYCD

Abetalipoproteinemia	MTTP
N-acetylglutamate synthase deficiency	NAGS
Ornithine transcarbamylase deficiency	OTC
Phenylketonuria (PKU)	PAH
Pyruvate carboxylase deficiency	PC
Hyperphenylalaninemia	PTS, QDPR
Propionicacidemia	PCCA, PCCB
Pyruvate dehydrogenase deficiency	PDHA1, PDHB
Phosphoglycerate kinase 1 deficiency	PGK1
Phosphoglycerate dehydrogenase deficiency	PHGDH
Refsum disease	PHYH
Pyridoxamine 5'-phosphate oxidase deficiency	PNPO
Phosphoribosylpyrophosphate synthetase superactivity	PRPS1
Neu-Laxova syndrome	PHGDH
Riboflavin transport deficiency syndrome	SLC52A2, SLC52A3
Lathosterolosis	SC5D
Thiamine metabolism dysfunction syndrome	SLC19A2, SLC19A3
Carnitine deficiency	SLC22A5
Hyperornithinemia-hyperammonemia-homocitrullinemia syndrome	SLC25A15
Acrodermatitis enteropathica	SLC39A4
Multiple sulfatase deficiency	SUMF1
Salla disease	SLC17A5
Sjogren-Larsson syndrome	ALDH3A2
Sulfite oxidase deficiency	SUOX
Barth syndrome	TAZ
Transcobalamin II deficiency	TCN2
Crigler-Najjar syndrome	UGT1A1
VLCAD deficiency	ACADVL
Wilson disease	ATP7B
Endocrine conditions	
Congenital adrenal hyperplasia*	
Severe salt wasting type	CYP11A1, CYP11B2, NR0B1, POU1F1, PROP1, HSD3B2
Lipoid type	STAR
**Excludes 21-hydroxylase deficiency, as the CYP21A2 gene is not screened for technical reasons*	
Other endocrine conditions	

Disordered steroidogenesis due to cytochrome P450 oxidoreductase	POR
Glucocorticoid deficiency	NNT
Hypothryoidism, congenital	TSHB
Laron syndrome	GHR
Pituitary hormone deficiency	LHX3
Neurological conditions	
White matter disorders	
Adrenoleukodystrophy	ABCD1
Aicardi-Goutieres syndrome	ADAR, RNASEH2A, RNASEH2B, RNASEH2C, SAMHD1, TREX1
Leukodystrophy, hypomyelinating	FAM126A, POLR3B, VPS11
Leukoencephalopathy with vanishing white matter	EIF2B1, EIF2B2, EIF2B3, EIF2B4, EIF2B5
Megalencephalic leukoencephalopathy with subcortical cysts	MLC1
Pelizaeus-Merzbacher disease	PLP1
Congenital brain malformations	
Pontocerebellar hypoplasia	AMPD2, CLP1, EXOSC3, EXOSC8, RARS2, SEPSECS, TBC1D23, TOE1, TSEN2, TSEN54, VPS53, VRK1
Lissencephaly	ARX, KATNB1, LAMB1, NDE1, DCX, TMTC3
Joubert syndrome	AHI1, ARL13B, CC2D2A, CEP290, CEP41, CPLANE1, CSPP1, INPP5E, KIF7, NPHP1, OFD1, PIBF1, RPGRIP1L, TCTN2, TCTN3, TMEM138, TMEM216, TMEM231, TMEM237, TMEM67
Polymicrogyria	ADGRG1
Band heterotopia	DCX
Cerebellar hypoplasia and intellectual disability with or without quadrupedal locomotion	VLDLR
Microcephaly	
Isolated	ASPM, CENPJ, CEP152, MCPH1, MED17, PNKP, WDR62
Hydrocephalus	
Non-syndromic hydrocephalus	L1CAM, CCDC88C
Hydrocephalus with congenital idiopathic intestinal pseudoobstruction	L1CAM
Hydrocephalus due to aqueductal stenosis	L1CAM
Hydrocephalus with Hirschsprung disease	L1CAM

Neurodegenerative conditions	
Neuronal ceroid lipofuscinoses	CLN3, CLN5, CLN6, CLN8, CTSD, MFSD8, PPT1, TPP1
Parkinson disease, juvenile-onset	FBXO7, PLA2G6
Encephalopathy, progressive	TBCD
Neurodegeneration with brain iron accumulation	PANK2, PLA2G6
Infantile neuroaxonal dystrophy 1	PLA2G6
Spastic tetraplegia, thin corpus callosum, and progressive microcephaly	SLC1A4
Ataxias	
Ataxia-telangiectasia	ATM, MRE11
Ataxia-oculomotor apraxia 4	PNKP
Ataxia with isolated vitamin E deficiency	TTPA
Cerebellar ataxia, cognitive disability, and disequilibrium (CAMRQ)	WDR81
Spastic ataxia	SACS
Spinocerebellar ataxia	TPP1, WWOX
Movement disorders	
Dystonia, dopa-responsive, due to sepiapterin reductase deficiency	SPR
Dystonia, DOPA-responsive, with or without hyperphenylalaninemia	GCH1
Segawa syndrome	TH
Epilepsy	
Epilepsy, pyridoxine-dependent	ALDH7A1
Epileptic encephalopathy, infantile	ARX, MECP2, PCDH19, TBC1D24, UBA5, WWOX
Epilepsy, progressive myoclonic	TBC1D24
Hyperekplexia	SLC6A5
Epilepsy, early-onset, vitamin B6-dependent	PLPBP
Epilepsy, X-linked, with variable learning disabilities and behaviour disorders	SYN1
Epilepsy, hearing loss, and intellectual disability syndrome	SPATA5
Amish infantile epilepsy syndrome	ST3GAL5
Intellectual disability	
Non-syndromic intellectual disability, X-linked	AP1S2, ARX, ATRX, BRWD3, CASK, CUL4B, DLG3, FTSJ1, HCFC1, IL1RAPL1, IQSEC2, MECP2, PAK3, SLC16A2, THOC2, USP9X, ZNF711

Non-syndromic intellectual disability, autosomal recessive	CC2D1A, METTL23, PIGG,
Cutaneous conditions	
Ichthyosis	
Ichthyosis, congenital, autosomal recessive	ABCA12, TGM1
Cutis laxa	
Cutis laxa, autosomal recessive	ALDH18A1
Ectodermal dysplasia	
Ectodermal dysplasia	EDA
Cutaneous conditions affecting the nervous system	
Xeroderma pigmentosum	ERCC2, ERCC4, ERCC5, XPA, XPC
Other cutaneous conditions	
Epidermolysis bullosa	COL7A1, COL17A1, ITGA6, ITGB4, KRT14, LAMA3, LAMB3, LAMC2
Porokeratosis 3, disseminated superficial actinic	MVK
Netherton syndrome	SPINK5
Restrictive dermopathy, lethal	LMNA
Triochthiodystrophy	ERCC2
Transient bullous of the newborn	COL7A1
Respiratory conditions	
Surfactant conditions	
Surfactant metabolism dysfunction, pulmonary	ABCA3
Ciliary dyskinesia	
Ciliary dyskinesia, primary	CCDC103, CCDC39,
Ciliary dyskinesia, primary, with or without situs inversus	DNAH11, DNAH5, DNAI1, DNAI2
Other respiratory conditions	
Cystic fibrosis	CFTR
Immunological conditions	
Chronic granulomatous disease	
Deficiency of NCF-2	NCF2
Deficiency of CYBA	CYBA
X-linked	CYBB
Combined cellular and humoral immune defects with granulomas	RAG1, RAG2
Immunodeficiencies	

Immunodeficiency	CD3D, IKBKB, PGM3
Mycobacteriosis	CYBB
Hyper-IgM	CD40, CD40LG
Hyper-IgD syndrome	MVK
Centromeric instability-facial anomalies syndrome	DNMT3B, ZBTB24
Combined immunodeficiency, moderate	IL2RG
Neutropenia	
Severe, congenital	G6PC3, HAX1, VPS45, WAS
Severe combined immunodeficiencies	
Severe combined immunodeficiency	IL2RG
Adenosine deaminase deficiency	ADA
Athabascan type	DCLRE1C
B cell-negative	RAG1, RAG2
T-cell negative, B-cell/natural killer cell-positive type	IL7R, JAK3
Reticular dysgenesis	AK2
Other immunological conditions	
Agammaglobulinemia	BTK
Bare lymphocyte syndrome	CIITA
Hemophagocytic lymphohistiocytosis	PRF1, STX11, STXBP2, UNC13D
Lymphoproliferative syndrome	XIAP
T-cell immunodeficiency, congenital alopecia, and nail dystrophy	FOXN1
Darsun syndrome	G6PC3
Omenn syndrome	DCLRE1C, RAG1, RAG2
Wiskott-Aldrich syndrome	WAS
Gastrointestinal conditions	
Severe congenital diarrhoea	
Secretory chloride, congenital	SLC26A3
Protein-losing enteropathy type	DGAT1
Hepatic conditions	
Cholestasis, progressive familial intrahepatic	ABCB11, ABCB4, ATP8B1
Liver failure, transient infantile	TRMU
Other gastrointestinal conditions	
Microvillus inclusion disease	MYO5B
Bile acid synthesis defect, congenital	CYP7B1
Congenital short bowel syndrome	FLNA

Trichohepatoenteric syndrome	SKIV2L, TTC37
Folate malabsorption, hereditary	SLC46A1
Gastrointestinal defects and immunodeficiency syndrome	TTC7A
Hyperbilirubinemia, familial transient neonatal	UGT1A1
Haematological conditions	
Anaemia	
Dyserythropoietic anaemia	SEC23B
Fanconi anaemia	ERCC4, FANCA, FANCB, FANCC, FANCD2, FANCE, FANCF, FANCG, FANCI, FANCL, UBE2T
Clotting conditions	
Hypoprothrombinemia	F2
Thrombocytopenia, congenital amegakaryocytic	MPL
Thrombocytopenia, X-linked	WAS
Other haematological conditions	
Beta thalassemia	HBB
Sickle cell disease	HBB
Atransferrinemia	TF
Cardiovascular conditions	
Arrhythmias	
Ventricular tachycardia, catecholaminergic polymorphic	CASQ2
Jervell and Lange-Nielsen syndrome	KCNQ1
Ventricular tachycardia, catecholaminergic polymorphic with or without muscle weakness	TRDN
Cardiomyopathies	
Dilated cardiomyopathy	FKTN
Structural cardiovascular conditions	
Arterial calcification of infancy	ENPP1
Cardiac valvular dysplasia, X-linked	FLNA
Right atrial isomerism	GDF1
Renal conditions	
Syndromic renal conditions	
Alport syndrome	COL4A3, COL4A4, COL4A5
Dent disease	OCRL, CLCN5
Renal tubular acidosis with other abnormalities	ATP6V1B1
Bartter syndrome	BSND, KCNJ1, SLC12A1

Renal-hepatic-pancreatic dysplasia	NPHP3
Polycystic kidney and hepatic disease	PKHD1
Nephrotic syndrome	LAMB2, NPHS1, NPHS2
Other renal conditions	
Nephronophthisis and related conditions	INVS, NPHP1, NPHP3, TMEM67
Nephrogenic diabetes insipidus	AQP2
Neuromuscular conditions	
Atrophy	
Spinal muscular atrophy	SMN1
Arthrogryposis	
Arthrogryposis lethal with anterior horn cell disease	GLE1
Dystrophy	
Limb-girdle muscular dystrophy	CAPN3, DYSF, SGCA, SGCB, SGCD, SGCG, TRIM32
Muscular dystrophy-dystroglycanopathy	FKRP, FKTN, LARGE1, POMGNT1, POMT1, POMT2
Muscular dystrophy, congenital	LAMA2
Ullrich congenital muscular dystrophy	COL6A1
Duchenne muscular dystrophy	DMD
Becker muscular dystrophy	DMD
Emery-Dreifuss muscular dystrophy	EMD, FHL1, LMNA
Myopathy	
Nemaline myopathy	NEB
Distal myopathy	DYSF
Myopathy, X-linked	FHL1
Inclusion body myopathy	GNE
Myotubular myopathy, X-linked	MTM1
Minicore myopathy	RYR1
Central core disease	RYR1
Myasthenia	
Myasthenic syndrome	CHAT, CHRNE, COLQ, DOK7, IGHMBP2, MUSK, RAPSN
Neuropathy	
Charcot-Marie-Tooth disease	GDAP1, GJB1, LMNA, MFN2, MTMR2, NDRG1, PRPS1, SH3TC2
Dysautonomia, familial	ELP1

Insensitivity to pain, congenital	NTRK1
Neuropathy, hereditary motor and sensory	IGHMBP2, KIF1A
Spasticity	
Spastic paraplegia	ALDH18A1, CYP7B1, KIF1A, PLP1, SPG11, ZFYVE26
Connective tissue conditions	
Ehlers-Danlos syndrome (EDS)	
Ehlers-Danlos syndrome, progeroid type	ADAMTS2, PLOD1
Ocular conditions	
Albinism	
Hermansky-Pudlak syndrome	HPS1, HPS3, HPS4, HPS5, HPS6
Oculocutaneous albinism	GPR143, SLC45A2, TYR, TYRP1
Dystrophies	
Retinal dystrophy, early-onset severe	LRAT
Macular dystrophy with central cone involvement	MFSD8
Cone-rod dystrophy	AIPL1, CNGB3
Microphthalmia	
Isolated	RAX, VSX2
With coloboma	VSX2
Other ocular conditions	
Achromatopsia	CNGB3
Congenital cataracts	AGK
Macular degeneration (congenital)	CNGB3
Leber congenital amaurosis	AIPL1, CEP290, CRB1, GUCY2D, LCA5, LRAT, RDH12, RPE65, TULP1
Glaucoma (congenital)	CYP1B1
Peters anomaly	CYP1B1
Retinitis pigmentosa	AIPL1, CRB1, DHDDS, LRAT, RP2, TULP1, USH2A
Progressive external ophthalmoplegia	POLG
Brittle cornea syndrome	PRDM5
Foveal hypoplasia, with or without optic nerve misrouting and/or anterior segment dysgenesis	SLC38A8
Skeletal conditions	
Dysplasias	
Spondyloepiphyseal dysplasia with other abnormalities	CCN6

Anauxetic dysplasia	RMRP
Desbuquois dysplasia	CANT1
Short-rib thoracic dysplasia with or without polydactyly	DYNC2H1, DYNC2I2^ ^Formerly known as WDR34
Chondrodysplasia, Grebe type	GDF5
Smith-McCort dysplasia	DYM
Otospondylomegaepiphyseal dysplasia	COL11A2
Metaphyseal dysplasia without hypotrichosis	RMRP
De la Chapelle dysplasia	SLC26A2
Diastrophic dysplasia	SLC26A2
Chondrodysplasia punctata, rhizomelic	AGPS, GNPAT, PEX7
Mandibuloacral dysplasia	LMNA
Acromesomelic dysplasia	
Hunter-Thompson type	GDF5
Arthropathies	
Arthropathy, progressive pseudorheumatoid	CCN6
Short stature and dwarfism	
Microcephalic osteodysplastic primordial dwarfism	PCNT
Mulibrey nanism	TRIM37
Other skeletal conditions	
Antley-Bixler syndrome	POR
Hypophosphatasia, infantile	ALPL
Osteopetrosis, infantile	CLCN7, OSTM1, TCIRG1
Fibrochondrogenesis	COL11A2
Osteogenesis imperfecta, recessive type	CRTAP, FKBP10, P3H1
Pycnodysostosis	CTSK
Spondylocostal dysostosis	DLL3, MESP2
Ellis-van Creveld syndrome	EVC, EVC2
Bruck syndrome	FKBP10
Brachydactyly	GDF5
Geroderma osteodysplasticum	GORAB
Stuve-Wiedemann syndrome/Schwartz-Jampel type 2 syndrome	LIFR
Carpenter syndrome	RAB23
Cartilage-hair hypoplasia	RMRP
Achondrogenesis	SLC26A2
Atelosteogenesis	SLC26A2

Kenny-Caffey syndrome	TBCE
Steel syndrome	COL27A1