Whole Exome Sequencing
Gene package Hearing impairment, version 2, 23-9-2016

Technical information
After DNA was enriched using Agilent Sureselect Clinical Research Exome (CRE) Capture, samples were run on the Illumina Hiseq platform. The aim is to obtain 50 million total reads per exome with a mapped fraction >0.98. The average coverage of the exome is ~50x. Data are demultiplexed by Illumina software bcl2fastq. Reads are mapped to the genome using BWA (reference: http://bio-bwa.sourceforge.net/). Variant detection is performed by Genome Analysis Toolkit (reference: http://www.broadinstitute.org/gatk/). Analysis is performed in Cartagenia using The Variant Calling File (VCF) followed by filtering. It is not excluded that pathogenic mutations are being missed using this technology. At this moment, there is not enough information about the sensitivity of this technique with respect to the detection of deletions and duplications of more than 5 nucleotides and of somatic mosaic mutations (all types of sequence changes).

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HGNC approved gene symbol	Phenotype description including OMIM phenotype ID(s)	OMIM gene ID	median depth	% covered >10x	% covered >20x
ACTB	?Dystonia, juvenile-onset, 607371 Baraitser-Winter syndrome 1, 243310	102630	77	100	100
ACTG1	Deafness, autosomal dominant 20/26, 604717 Baraitser-Winter syndrome 2, 614583	102560	104	100	100
ADCY1	?Deafness, autosomal recessive 44, 610154	103072	55	95	89
AIFM1	Combined oxidative phosphorylation deficiency 6, 300816 Cowchock syndrome, 310490 Deafness, X-linked 5, 300614	300169	79	100	99
APOPT1	Mitochondrial complex IV deficiency, 220110	616003	55	100	94
ATP1A2	Migraine, familial hemiplegic, 2, 602481 Alternating hemiplegia of childhood, 104290 Migraine, familial basilar, 602481	182340	35	97	80
ATP6V1B1	Renal tubular acidosis with deafness, 267300	192132	109	100	100
BDP1	No OMIM phenotype	607012	115	100	100
BSND	Bartter syndrome, type 4a, 602522 Sensorineural deafness with mild renal dysfunction, 602522	606412	43	88	72
C10orf2	Progressive external ophthalmoplegia with mitochondrial DNA deletions, autosomal dominant 3, 609286 Mitochondrial DNA depletion syndrome 7 (hepatocerebral type), 271245 Perrault syndrome 5, 616138	606075	104	100	100
CABP2	Deafness, autosomal recessive 93, 614899	607314	103	100	100

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CACNA1D	Sinoatrial node dysfunction and deafness, 614896 Primary aldosteronism, seizures, and neurologic abnormalities, 615474	114206	58	100	95
CC2D2A	Joubert syndrome 9, 612285 Meckel syndrome 6, 612284 COACH syndrome, 216360	612013	95	100	99
CCDC50	?Deafness, autosomal dominant 44, 607453	611051	82	100	99
CD164	No OMIM phenotype	603356	69	100	100
CDH23	Usher syndrome, type 1D, 601067 Deafness, autosomal recessive 12, 601386 Usher syndrome, type 1D/F digenic, 601067	605516	47	93	91
CEACAM16	?Deafness, autosomal dominant 4B, 614614	614591	119	100	100
CIB2	Deafness, autosomal recessive 48, 609439 Usher syndrome, type IJ, 614869	605564	88	100	100
CLDN14	Deafness, autosomal recessive 29, 614035	605608	109	100	100
CLIC5	?Deafness, autosomal recessive 103, 616042	607293	55	100	100
CLPP	Perrault syndrome 3, 614129	601119	44	100	94
CLRN1	Usher syndrome, type 3A, 276902 Retinitis pigmentosa 61, 614180	606397	60	97	90
COCH	Deafness, autosomal dominant 9, 601369	603196	105	100	100
COL11A1	Stickler syndrome, type II, 604841 Marshall syndrome, 154780 {Lumbar disc herniation, susceptibility to}, 603932 Fibrochondrogenesis 1, 228520	120280	111	100	100
COL11A2	Stickler syndrome, type III, 184840 Otospondylomegaepiphyseal dysplasia, 215150 Weissenbacher-Zweymuller syndrome, 277610 Deafness, autosomal dominant 13, 601868 Deafness, autosomal recessive 53, 609706 Fibrochondrogenesis 2, 614524	120290	56	98	88

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COL2A1	Stickler syndrome, type I, 108300 Kniest dysplasia, 156550 Achondrogenesis, type II or hypochondrogenesis, 200610 SED congenita, 183900 SMED Strudwick type, 184250 Epiphyseal dysplasia, multiple, with myopia and deafness, 132450 Spondyloperipheral dysplasia, 271700 Osteoarthritis with mild chondrodysplasia, 604864 Vitreoretinopathy with phalangeal epiphyseal dysplasia Platyspondylic skeletal dysplasia, Torrance type, 151210 Otospondylomegaepiphyseal dysplasia, 215150 Avascular necrosis of the femoral head, 608805 Legg-Calve-Perthes disease, 150600 Stickler sydrome, type I, nonsyndromic ocular, 609508 Czech dysplasia, 609162 Spondyloepiphyseal dysplasia, Stanescu type, 616583	120140	64	100	97
COL4A3	Alport syndrome, autosomal recessive, 203780 Hematuria, benign familial, 141200 Alport syndrome, autosomal dominant, 104200	120070	74	100	99
COL4A4	Alport syndrome, autosomal recessive, 203780 Hematuria, familial benign	120131	62	98	97
COL4A5	Alport syndrome, 301050	303630	62	100	96
COL4A6	?Deafness, X-linked 6, 300914	303631	34	97	79
COL9A1	?Epiphyseal dysplasia, multiple, 6, 614135 Stickler syndrome, type IV, 614134	120210	40	98	87
COL9A2	Epiphyseal dysplasia, multiple, 2, 600204 {Intervertebral disc disease, susceptibility to}, 603932 ?Stickler syndrome, type V, 614284	120260	71	99	95
CRYM	Deafness, autosomal dominant 40, 616357	123740	50	100	94
DCDC2	Nephronophthisis 19, 616217 ?Deafness, autosomal recessive 66, 610212	605755	70	100	100
DFNA5	Deafness, autosomal dominant 5, 600994	608798	58	100	93
DFNB59	Deafness, autosomal recessive 59, 610220	610219	88	100	100
DIAPH1	Deafness, autosomal dominant 1, 124900 Seizures, cortical blindness, microcephaly syndrome, 616632	602121	79	100	97
DIAPH3	Auditory neuropathy, autosomal dominant, 1, 609129	614567	80	100	96

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DSPP	Dentinogenesis imperfecta, Shields type II, 125490 Deafness, autosomal dominant 39, with dentinogenesis, 605594 Dentinogenesis imperfecta, Shields type III, 125500 Dentin dysplasia, type II, 125420	125485	54	100	92
EDN3	Waardenburg syndrome, type 4B, 613265 Central hypoventilation syndrome, congenital, 209880 {Hirschsprung disease, susceptibility to, 4}, 613712	131242	49	84	61
EDNRB	{Hirschsprung disease, susceptibility to, 2}, 600155 ABCD syndrome, 600501 Waardenburg syndrome, type 4A, 277580	131244	103	100	100
ELMOD3	?Deafness, autosomal recessive 88, 615429	615427	93	100	100
EPS8	?Deafness, autosomal recessive 102, 615974	600206	65	100	94
ESPN	Deafness, autosomal recessive 36, 609006 Deafness, neurosensory, without vestibular involvement, autosomal dominant	606351	41	90	75
ESRRB	Deafness, autosomal recessive 35, 608565	602167	37	84	66
EYA1	Branchiootorenal syndrome 1, with or without cataracts, 113650 Anterior segment anomalies with or without cataract, 113650 Branchiootic syndrome 1, 602588 ?Otofaciocervical syndrome, 166780	601653	80	100	100
EYA4	Deafness, autosomal dominant 10, 601316 Cardiomyopathy, dilated, 1J, 605362	603550	78	100	96
FAM65B	?Deafness, autosomal recessive 104, 616515	611410	82	100	100
FGF3	Deafness, congenital with inner ear agenesis, microtia, and microdontia, 610706	164950	46	99	91
FOXI1	Enlarged vestibular aqueduct, 600791	601093	60	100	97
GIPC3	Deafness, autosomal recessive 15, 601869	608792	84	100	100
GJB2	Deafness, autosomal recessive 1A, 220290 Deafness, autosomal dominant 3A, 601544 Vohwinkel syndrome, 124500 Keratoderma, palmoplantar, with deafness, 148350 Keratitis-ichthyosis-deafness syndrome, 148210 Hystrix-like ichthyosis with deafness, 602540 Bart-Pumphrey syndrome, 149200	121011	70	94	88
GJB3	Erythrokeratodermia variabilis et progressiva, 133200 Deafness, autosomal dominant 2B, 612644 Deafness, autosomal recessive Deafness, autosomal dominant, with peripheral neuropathy Deafness, digenic, GJB2/GJB3, 220290	603324	122	100	100

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GJB6	Deafness, autosomal dominant 3B, 612643 Deafness, autosomal recessive 1B, 612645 Deafness, digenic GJB2/GJB6, 220290 Ectodermal dysplasia 2, Clouston type, 129500	604418	114	100	100
GPR98	Febrile seizures, familial, 4, 604352 Usher syndrome, type 2C, 605472 Usher syndrome, type 2C, GPR98/PDZD7 digenic, 605472	602851	90	100	100
GPSM2	Chudley-McCullough syndrome, 604213	609245	76	100	97
GRHL2	Deafness, autosomal dominant 28, 608641 Ectodermal dysplasia/short stature syndrome, 616029	608576	75	100	99
GRXCR1	Deafness, autosomal recessive 25, 613285	613283	93	100	100
GRXCR2	?Deafness, autosomal recessive 101, 615837	615762	47	100	96
HARS	Usher syndrome type 3B, 614504 Charcot-Marie-Tooth disease, axonal, type 2W, 616625	142810	86	100	99
HARS2	?Perrault syndrome 2, 614926	600783	107	100	100
HGF	Deafness, autosomal recessive 39, 608265	142409	83	100	99
HOMER2	?Deafness, autosomal dominant 68, 616707	604799	50	99	91
HSD17B4	D-bifunctional protein deficiency, 261515 Perrault syndrome 1, 233400	601860	63	99	96
ILDR1	Deafness, autosomal recessive 42, 609646	609739	63	100	97
KARS	?Charcot-Marie-Tooth disease, recessive intermediate, B, 613641 Deafness, autosomal recessive 89, 613916	601421	100	100	100
KCNE1	Jervell and Lange-Nielsen syndrome 2, 612347 Long QT syndrome 5, 613695	176261	163	100	100
KCNJ10	SESAME syndrome, 612780 Enlarged vestibular aqueduct, digenic, 600791	602208	122	100	100
KCNQ1	Long QT syndrome 1, 192500 Jervell and Lange-Nielsen syndrome, 220400 Atrial fibrillation, familial, 3, 607554 Short QT syndrome 2, 609621 {Long QT syndrome 1, acquired, susceptibility to}, 192500	607542	75	93	90
KCNQ4	Deafness, autosomal dominant 2A, 600101	603537	98	95	94
KITLG	[Skin/hair/eye pigmentation 7, blond/brown hair], 611664 Hyperpigmentation with or without hypopigmentation, 145250 Deafness, congenital, unilateral or asymmetric, 616697	184745	55	100	95
LARS2	Perrault syndrome 4, 615300	604544	50	100	97
LHFPL5	Deafness, autosomal recessive 67, 610265	609427	123	100	100
LOXHD1	Deafness, autosomal recessive 77, 613079	613072	100	100	100
LRTOMT	Deafness, autosomal recessive 63, 611451	612414	98	100	100

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MARVELD2	Deafness, autosomal recessive 49, 610153	610572	91	100	98
MCM2	No OMIM phenotype	116945	62	100	98
MIR96	Deafness, autosomal dominant 50, 613074	611606	No coverage data		
MITF	Waardenburg syndrome, type 2A, 193510 Waardenburg syndrome/ocular albinism, digenic, 103470 Tietz albinism-deafness syndrome, 103500 {Melanoma, cutaneous malignant, susceptibility to, 8}, 614456	156845	54	100	98
MSRB3	Deafness, autosomal recessive 74, 613718	613719	72	100	99
MYH14	Deafness, autosomal dominant 4A, 600652 ?Peripheral neuropathy, myopathy, hoarseness, and hearing loss, 614369	608568	70	99	95
MYH9	May-Hegglin anomaly, 155100 Fechtner syndrome, 153640 Sebastian syndrome, 605249 Deafness, autosomal dominant 17, 603622 Epstein syndrome, 153650 Macrothrombocytopenia and progressive sensorineural deafness, 600208	160775	91	100	100
MYO15A	Deafness, autosomal recessive 3, 600316	602666	83	98	94
MYO3A	Deafness, autosomal recessive 30, 607101	606808	70	100	98
MYO6	Deafness, autosomal dominant 22, 606346 Deafness, autosomal recessive 37, 607821 Deafness, autosomal dominant 22, with hypertrophic cardiomyopathy, 606346	600970	59	100	94
MYO7A	Usher syndrome, type 1B, 276900 Deafness, autosomal recessive 2, 600060 Deafness, autosomal dominant 11, 601317	276903	100	100	98
NARS2	Combined oxidative phosphorylation deficiency 24, 616239	612803	67	97	97
NLRP3	Familial cold-induced inflammatory syndrome 1, 120100 Muckle-Wells syndrome, 191900 CINCA syndrome, 607115	606416	102	100	100
OPA1	Optic atrophy 1, 165500 {Glaucoma, normal tension, susceptibility to}, 606657 Optic atrophy plus syndrome, 125250	605290	69	100	93
OSBPL2	Deafness, autosomal dominant 67, 616340	606731	54	100	94
OTOA	Deafness, autosomal recessive 22, 607039	607038	88	100	98
OTOF	Deafness, autosomal recessive 9, 601071 Auditory neuropathy, autosomal recessive, 1, 601071	603681	90	100	99
OTOGL	Deafness, autosomal recessive 84B, 614944	614925	68	100	96
P2RX2	Deafness, autosomal dominant 41, 608224	600844	61	100	95

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PAX3	Waardenburg syndrome, type 1, 193500 Waardenburg syndrome, type 3, 148820 Craniofacial-deafness-hand syndrome, 122880 Rhabdomyosarcoma 2, alveolar, 268220	606597	71	100	100
PCDH15	Usher syndrome, type 1F, 602083 Deafness, autosomal recessive 23, 609533 Usher syndrome, type 1D/F digenic, 601067	605514	89	100	98
PDZD7	{Retinal disease in Usher syndrome type IIA, modifier of}, 276901 Usher syndrome, type IIC, GPR98/PDZD7 digenic, 605472	612971	60	99	96
PEX1	Peroxisome biogenesis disorder 1A (Zellweger), 214100 Peroxisome biogenesis disorder 1B (NALD/IRD), 601539 Heimler syndrome 1, 234580	602136	67	100	98
PEX6	Peroxisome biogenesis disorder 4A (Zellweger), 614862 Peroxisome biogenesis disorder 4B, 614863 Heimler syndrome 2, 616617	601498	71	95	91
PNPT1	Combined oxidative phosphorylation deficiency 13, 614932 Deafness, autosomal recessive 70, 614934	610316	33	87	63
POU3F4	Deafness, X-linked 2, 304400	300039	49	100	100
POU4F3	Deafness, autosomal dominant 15, 602459	602460	131	100	100
PRPS1	Gout, PRPS-related, 300661 Phosphoribosylpyrophosphate synthetase superactivity, 300661 Charcot-Marie-Tooth disease, X-linked recessive, 5, 311070 Arts syndrome, 301835 Deafness, X-linked 1, 304500	311850	59	100	100
PTPRQ	Deafness, autosomal recessive 84A, 613391	603317	69	99	95
RDX	Deafness, autosomal recessive 24, 611022	179410	51	100	93
S1PR2	No OMIM phenotype	605111	83	97	89
SERPINB6	?Deafness, autosomal recessive 91, 613453	173321	99	100	100
SIX1	Brachiootic syndrome 3, 608389 Deafness, autosomal dominant 23, 605192	601205	90	100	100
SIX5	Branchiootorenal syndrome 2, 610896	600963	45	94	82
SLC17A8	Deafness, autosomal dominant 25, 605583	607557	81	100	99
SLC26A4	Pendred syndrome, 274600 Deafness, autosomal recessive 4, with enlarged vestibular aqueduct, 600791	605646	82	100	98
SLC26A5	?Deafness, autosomal recessive 61, 613865	604943	90	100	100
SLC33A1	Spastic paraplegia 42, autosomal dominant, 612539 Congenital cataracts, hearing loss, and neurodegeneration, 614482	603690	62	100	96
SLITRK6	Deafness and myopia, 221200	609681	93	100	100
SMPX	Deafness, X-linked 4, 300066	300226	50	100	94

HGNC approved gene symbol	Phenotype description including OMIM phenotype ID(s)	OMIM gene ID	median depth	% covered >10x	% covered >20x
SNAI2	Waardenburg syndrome, type 2D, 608890 Piebaldism, 172800	602150	71	100	92
SOX10	Waardenburg syndrome, type 4C, 613266 Waardenburg syndrome, type 2E, with or without neurologic involvement, 611584 PCWH syndrome, 609136	602229	45	99	87
STRC	Deafness, autosomal recessive 16, 603720	606440	73	100	97
SYNE4	Deafness, autosomal recessive 76, 615540	615535	36	99	85
TBC1D24	Myoclonic epilepsy, infantile, familial, 605021 Epileptic encephalopathy, early infantile, 16, 615338 DOOR syndrome, 220500 Deafness , autosomal recessive 86, 614617 Deafness, autosomal dominant 65, 616044	613577	92	100	100
TECTA	Deafness, autosomal dominant 8/12, 601543 Deafness, autosomal recessive 21, 603629	602574	101	100	100
TIMM8A	Mohr-Tranebjaerg syndrome, 304700 Jensen syndrome, 311150	300356	42	100	100
TJP2	Hypercholanemia, familial, 607748 Cholestasis, progressive familial intrahepatic 4, 615878	607709	83	100	99
TMC1	Deafness, autosomal recessive 7, 600974 Deafness, autosomal dominant 36, 606705	606706	68	100	100
TMEM132E	No OMIM phenotype	616178	54	93	86
TMIE	Deafness, autosomal recessive 6, 600971	607237	68	99	88
TMPRSS3	Deafness, autosomal recessive 8/10, 601072	605511	94	100	100
TNC	Deafness, autosomal dominant 56, 615629	187380	64	99	92
TPRN	Deafness, autosomal recessive 79, 613307	613354	49	80	71
TRIOBP	Deafness, autosomal recessive 28, 609823	609761	120	100	99
TSPEAR	Deafness, autosomal recessive 98, 614861	612920	97	100	100
TYR	Albinism, oculocutaneous, type IA, 203100 Waardenburg syndrome/albinism, digenic, 103470 Albinism, oculocutaneous, type IB, 606952 [Skin/hair/eye pigmentation 3, light/dark/freckling skin], 601800 {Melanoma, cutaneous malignant, susceptibility to, 8}, 601800 [Skin/hair/eye pigmentation 3, blue/green eyes], 601800	606933	71	100	100
USH1C	Usher syndrome, type 1C, 276904 Deafness, autosomal recessive 18A, 602092	605242	70	100	91
USH1G	Usher syndrome, type 1G, 606943	607696	86	100	99
USH2A	Usher syndrome, type 2A, 276901 Retinitis pigmentosa 39, 613809	608400	90	100	100

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WFS1	Wolfram syndrome, 222300 Deafness, autosomal dominant 6/14/38, 600965 Wolfram-like syndrome, autosomal dominant, 614296 {Diabetes mellitus, noninsulin-dependent, association with}, 125853 ?Cataract 41, 116400	606201	102	100	100
WHRN	Deafness, autosomal recessive 31, 607084 Usher syndrome, type 2D, 611383	607928	No coverage data		
YAP1	Coloboma, ocular, with or without hearing impairment, cleft lip/palate, and/or mental retardation, 120433 Coloboma, ocular, 120433	606608	40	86	73

- Gene symbols according HGCN
- OMIM release used: 17-3-2016
- "No OMIM phenotypes" indicates a gene without a current OMIM association
- OMIM phenotypes between "[ ]", indicate "nondiseases," mainly genetic variations that lead to apparently abnormal laboratory test values
- OMIM phenotypes between "{}", indicate risk factors
- OMIM phenotypes with a question mark, "?", before the disease name indicates an unconfirmed or possibly spurious mapping.
- The statistics above are based on a set of 50 samples
- Median depth is the median of the mean sequence depth over the protein coding exons of the transcript
- % Covered 10x describes the percentage of a gene's coding sequence that is covered at least 10x
- % Covered 20x describes the percentage of a gene's coding sequence that is covered at least 20x