

# CRANIOFACIAL ANOMALIES GENE PANEL DG 2.7/DG 2.8

<i>Gene</i>	<i>Median coverage</i>	<i>% covered &gt; 10x</i>	<i>% covered &gt; 20x</i>	<i>Associated Phenotype description and OMIM disease ID</i>
ADAMTSL4	96.9	99%	97%	Ectopia lentis et pupillae, 225200 Ectopia lentis, isolated, autosomal recessive, 225100
ALX1	171.3	99%	96%	?Frontonasal dysplasia 3, 613456
ALX3	125.6	78%	71%	Frontonasal dysplasia 1, 136760
ALX4	132.6	96%	89%	Frontonasal dysplasia 2, 613451 Parietal foramina 2, 609597 {Craniosynostosis 5, susceptibility to}, 615529
AMELX	95.2	99%	96%	Amelogenesis imperfecta, type 1E, 301200
ANKRD11	107.9	97%	93%	KBG syndrome, 148050
AXIN2	133.3	100%	99%	Colorectal cancer, somatic, 114500 Oligodontia-colorectal cancer syndrome, 608615
BCOR	131.4	99%	97%	Microphthalmia, syndromic 2, 300166
BMP4	154.5	100%	99%	Microphthalmia, syndromic 6, 607932 Orofacial cleft 11, 600625
C4orf26	226.3	100%	100%	Amelogenesis imperfecta, type IIA4, 614832
CDC45	184.7	99%	97%	Meier-Gorlin syndrome 7, 617063
CDON	156.1	99%	99%	Holoprosencephaly 11, 614226
CDSN	25.5	63%	46%	Hypotrichosis 2, 146520 Peeling skin syndrome 1, 270300
CHD7	161	99%	98%	CHARGE syndrome, 214800 Hypogonadotropic hypogonadism 5 with or without anosmia, 612370
COL11A1	98.5	94%	88%	Fibrochondrogenesis 1, 228520 Marshall syndrome, 154780 Stickler syndrome, type II, 604841 {Lumbar disc herniation, susceptibility to}, 603932
COL11A2	14.1	57%	23%	Deafness, autosomal dominant 13, 601868 Deafness, autosomal recessive 53, 609706 Fibrochondrogenesis 2, 614524

				Otospondylomegaepiphyseal dysplasia, 215150 Stickler syndrome, type III, 184840 Weissenbacher-Zweymuller syndrome, 277610
COL2A1	115.2	99%	98%	Achondrogenesis, type II or hypochondrogenesis, 200610 Avascular necrosis of the femoral head, 608805 Czech dysplasia, 609162 Epiphyseal dysplasia, multiple, with myopia and deafness, 132450 Kniest dysplasia, 156550 Legg-Calve-Perthes disease, 150600 Osteoarthritis with mild chondrodysplasia, 604864 Otospondylomegaepiphyseal dysplasia, 215150 Platyspondylic skeletal dysplasia, Torrance type, 151210 SED congenita, 183900 SMED Strudwick type, 184250 Spondyloepiphyseal dysplasia, Stanescu type, 616583 Spondyloperipheral dysplasia, 271700 Stickler syndrome, type I, nonsyndromic ocular, 609508 Stickler syndrome, type I, 108300 Vitreoretinopathy with phalangeal epiphyseal dysplasia
COL9A1	128.2	99%	95%	Stickler syndrome, type IV, 614134 /?Epiphyseal dysplasia, multiple, 6, 614135
COL9A2	69.7	98%	91%	Epiphyseal dysplasia, multiple, 2, 600204 ?Stickler syndrome, type V, 614284 {Intervertebral disc disease, susceptibility to}, 603932
COL9A3	73.8	96%	88%	Epiphyseal dysplasia, multiple, 3, with or without myopathy, 600969 {Intervertebral disc disease, susceptibility to}, 603932
CTSK	117.2	100%	99%	Pycnodysostosis, 265800
DHODH	111.8	100%	99%	Miller syndrome, 263750
DISP1	222.4	99%	99%	No OMIM phenotype Craniofacial and neuro-developmental abnormalities (Roessler (2009) Hum Genet 125,393) Diaphragmatic hernia, congenital (Kantarci (2010) Am J Med Genet A 152A,2493) Tetralogy of Fallot (Silversides (2012) PLoS Genet 8, e1002843)
DLX3	137.4	100%	99%	Amelogenesis imperfecta, type IV, 104510 Trichodontoosseous syndrome, 190320
DLX4	146.1	99%	99%	?Orofacial cleft 15, 616788

DSPP	191	100%	99%	Deafness, autosomal dominant 39, with dentinogenesis, 605594 Dentin dysplasia, type II, 125420 Dentinogenesis imperfecta, Shields type II, 125490 Dentinogenesis imperfecta, Shields type III, 125500
EDA	101	90%	79%	Ectodermal dysplasia 1, hypohidrotic, X-linked, 305100 Tooth agenesis, selective, X-linked 1, 313500
EDAR	145.9	99%	98%	Ectodermal dysplasia 10A, hypohidrotic/hair/nail type, autosomal dominant, 129490 Ectodermal dysplasia 10B, hypohidrotic/hair/tooth type, autosomal recessive, 224900 [Hair morphology 1, hair thickness], 612630
EDARADD	98.6	97%	92%	Ectodermal dysplasia 11A, hypohidrotic/hair/tooth type, autosomal dominant, 614940 Ectodermal dysplasia 11B, hypohidrotic/hair/tooth type, autosomal recessive, 614941
EDN1	158.5	100%	100%	Auriculocondylar syndrome 3, 615706 Question mark ears, isolated, 612798 {High density lipoprotein cholesterol level QTL 7}
EFNA4	118.4	100%	100%	No OMIM phenotype Craniosynostosis 1 (Merrill et al. (2006) Hum Molec Genet 15)
EFNB1	142.4	100%	99%	Craniofrontonasal dysplasia, 304110
EFTUD2	125.4	99%	99%	Mandibulofacial dysostosis, Guion-Almeida type, 610536
EIF4A3	122.1	100%	99%	Robin sequence with cleft mandible and limb abnormalities, 268305
ENAM	152.1	100%	99%	Amelogenesis imperfecta, type IB, 104500 Amelogenesis imperfecta, type IC, 204650
ERF	125.9	99%	97%	Craniosynostosis 4, 600775
EYA1	160.1	99%	98%	Anterior segment anomalies with or without cataract, 113650 Branchiootic syndrome 1, 602588 Branchiootorenal syndrome 1, with or without cataracts, 113650 ?Otofaciocervical syndrome, 166780
EZH2	153.3	99%	98%	Weaver syndrome, 277590
FAM83H	83.2	95%	89%	Amelogenesis imperfecta, type III, 130900
FGD1	98.1	95%	89%	Aarskog-Scott syndrome, 305400 Mental retardation, X-linked syndromic 16, 305400
FGF10	150.1	100%	100%	Aplasia of lacrimal and salivary glands, 180920 LADD syndrome, 149730
FGF3	80.8	95%	83%	Deafness, congenital with inner ear agenesis, microtia, and microdontia, 610706
FGF8	127.4	85%	79%	Hypogonadotropic hypogonadism 6 with or without anosmia, 612702

FGFR1	161.5	99%	97%	<p>Encephalocraniocutaneous lipomatosis,613001</p> <p>Hartsfield syndrome, 615465</p> <p>Hypogonadotropic hypogonadism 2 with or without anosmia, 147950</p> <p>Jackson-Weiss syndrome, 123150</p> <p>Osteoglophonic dysplasia, 166250</p> <p>Pfeiffer syndrome, 101600</p> <p>Trigonocephaly 1, 190440</p>
FGFR2	156.4	96%	95%	<p>Antley-Bixler syndrome without genital anomalies or disordered steroidogenesis, 207410</p> <p>Apert syndrome, 101200</p> <p>Beare-Stevenson cutis gyrata syndrome, 123790</p> <p>Bent bone dysplasia syndrome, 614592</p> <p>Craniofacial-skeletal-dermatologic dysplasia, 101600</p> <p>Craniosynostosis, nonspecific</p> <p>Crouzon syndrome, 123500</p> <p>Gastric cancer, somatic, 613659</p> <p>Jackson-Weiss syndrome, 123150</p> <p>LADD syndrome, 149730</p> <p>Pfeiffer syndrome, 101600</p> <p>Saethre-Chotzen syndrome, 101400</p> <p>Scaphocephaly and Axenfeld-Rieger anomaly</p> <p>Scaphocephaly, maxillary retrusion, and mental retardation, 609579</p>
FGFR3	120.2	99%	99%	<p>Achondroplasia, 100800</p> <p>Bladder cancer, somatic, 109800</p> <p>CATSHL syndrome, 610474</p> <p>Cervical cancer, somatic, 603956</p> <p>Colorectal cancer, somatic, 114500</p> <p>Crouzon syndrome with acanthosis nigricans, 612247</p> <p>Hypochondroplasia, 146000</p> <p>LADD syndrome, 149730</p> <p>Muenke syndrome, 602849</p> <p>Nevus, epidermal, somatic, 162900</p> <p>SADDAN, 616482</p> <p>Spermatocytic seminoma, somatic, 273300</p> <p>Thanatophoric dysplasia, type I, 187600</p> <p>Thanatophoric dysplasia, type II, 187601</p>

FOXC1	40.5	93%	77%	Axenfeld-Rieger syndrome, type 3, 602482 Iridogoniodysgenesis, type 1, 601631 Iris hypoplasia and glaucoma, 601631 Rieger or Axenfeld anomalies, 602482
FOXE1	31.4	76%	60%	Bamforth-Lazarus syndrome, 241850 {Thyroid cancer, nonmedullary, 4}, 616534
GDF3	139.5	100%	100%	Klippel-Feil syndrome 3, autosomal dominant, 613702 Microphthalmia with coloboma 6, 613703 Microphthalmia, isolated 7, 613704
GDF6	85.6	97%	89%	Klippel-Feil syndrome 1, autosomal dominant, 118100 Leber congenital amaurosis 17, 615360 Microphthalmia with coloboma 6, digenic, 613703 Microphthalmia, isolated 4, 613094
GJA1	218.1	100%	100%	Atrioventricular septal defect 3, 600309 Craniometaphyseal dysplasia, autosomal recessive, 218400 Erythrokeratoderma variabilis et progressiva, 133200 Hypoplastic left heart syndrome 1, 241550 Oculodentodigital dysplasia, 164200 Oculodentodigital dysplasia, autosomal recessive, 257850 Palmoplantar keratoderma with congenital alopecia, 104100 Syndactyly, type III, 186100
GJB6	226.9	100%	100%	Deafness, autosomal dominant 3B, 612643 Deafness, autosomal recessive 1B, 612645 Deafness, digenic GJB2/GJB6, 220290 Ectodermal dysplasia 2, Clouston type, 129500
GLI2	139.5	98%	96%	Culler-Jones syndrome, 615849 Holoprosencephaly-9, 610829
GLI3	170.9	100%	99%	Greig cephalopolysyndactyly syndrome, 175700 Pallister-Hall syndrome, 146510 Polydactyly, postaxial, types A1 and B, 174200 Polydactyly, preaxial, type IV, 174700 {Hypothalamic hamartomas, somatic}, 241800
GNAI3	126.8	99%	94%	Auriculocondylar syndrome 1, 602483
GRHL3	160	100%	100%	Van der Woude syndrome 2, 606713
HOXA2	90.9	99%	95%	?Microtia with or without hearing impairment (AD), 612290

				?Microtia, hearing impairment, and cleft palate (AR), 612290
IFT122	164.4	100%	99%	Cranioectodermal dysplasia 1, 218330
IFT43	130.6	100%	100%	Cranioectodermal dysplasia 3, 614099
IKBKG	56.2	84%	70%	Ectodermal dysplasia, hypohidrotic, with immune deficiency, 300291 Ectodermal, dysplasia, anhidrotic, lymphedema and immunodeficiency, 300301 Immunodeficiency 33, 300636 Immunodeficiency, isolated, 300584 Incontinentia pigmenti, 308300 Invasive pneumococcal disease, recurrent isolated, 2, 300640
IL11RA	152.1	100%	99%	Craniosynostosis and dental anomalies, 614188
IRF6	136	99%	97%	Popliteal pterygium syndrome 1, 119500 van der Woude syndrome, 119300 {Orofacial cleft 6}, 608864
KAT6B	202.7	99%	98%	Genitopatellar syndrome, 606170 SBBYSS syndrome, 603736
KDM1A	154.5	98%	96%	Cleft palate, psychomotor retardation, and distinctive facial features, 616728
KDM6A	127.5	93%	86%	Kabuki syndrome 2, 300867
KLK4	210.9	99%	98%	Amelogenesis imperfecta, type IIA1, 204700
KMT2D	162.1	99%	99%	Kabuki syndrome 1, 147920
KREMEN1	164.9	96%	93%	No OMIM phenotype
LRP2	199.9	100%	99%	Donnai-Barrow syndrome, 222448
LRP6	186.6	100%	99%	Tooth agenesis, selective, 7, 616724 {Coronary artery disease, autosomal dominant, 2}, 610947
LTBP3	126.4	98%	96%	Dental anomalies and short stature, 601216
MASP1	161.2	100%	99%	3MC syndrome 1, 257920
MED12	116.5	98%	95%	Lujan-Fryns syndrome, 309520 Ohdo syndrome, X-linked, 300895 Opitz-Kaveggia syndrome, 305450
MEGF8	134	99%	98%	Carpenter syndrome 2, 614976
MEOX1	105.4	98%	94%	Klippel-Feil syndrome 2, 214300
MID1	196.6	99%	98%	Opitz GBBB syndrome, type I, 300000
MITF	163	99%	99%	Tietz albinism-deafness syndrome, 103500 Waardenburg syndrome, type 2A, 193510 Waardenburg syndrome/ocular albinism, digenic, 103470

				{Melanoma, cutaneous malignant, susceptibility to, 8}, 614456
MMP20	117.5	99%	99%	Amelogenesis imperfecta, type IIA2, 612529
MSX1	88.1	97%	91%	Ectodermal dysplasia 3, Witkop type, 189500 Orofacial cleft 5, 608874 Tooth agenesis, selective, 1, with or without orofacial cleft, 106600
MSX2	105.4	99%	94%	Craniosynostosis, type 2, 604757 Parietal foramina 1, 168500 Parietal foramina with cleidocranial dysplasia, 168550
NAA10	111	99%	96%	Ogden syndrome, 300855 ?Microphthalmia, syndromic 1, 309800
NFKBIA	117.7	98%	94%	Ectodermal dysplasia, anhidrotic, with T-cell immunodeficiency, 612132
NIPBL	129.3	96%	94%	Cornelia de Lange syndrome 1, 122470
NOG	195.2	100%	99%	Brachydactyly, type B2, 611377 Multiple synostoses syndrome 1, 186500 Stapes ankylosis with broad thumb and toes, 184460 Symphalangism, proximal, 1A, 185800 Tarsal-carpal coalition syndrome, 186570
NSD1	172.3	100%	99%	Beckwith-Wiedemann syndrome, 130650 Leukemia, acute myeloid, 601626 Sotos syndrome 1, 117550
OFD1	56.1	84%	71%	Joubert syndrome 10, 300804 Orofaciodigital syndrome I, 311200 Simpson-Golabi-Behmel syndrome, type 2, 300209 ?Retinitis pigmentosa 23, 300424
OTX2	149.8	100%	99%	Microphthalmia, syndromic 5, 610125 Pituitary hormone deficiency, combined, 6, 613986 Retinal dystrophy, early-onset, with or without pituitary dysfunction, 610125
PAX3	129.7	99%	99%	Craniofacial-deafness-hand syndrome, 122880 Rhabdomyosarcoma 2, alveolar, 268220 Waardenburg syndrome, type 1, 193500 Waardenburg syndrome, type 3, 148820
PAX6	156.1	100%	99%	Aniridia, 106210 Cataract with late-onset corneal dystrophy, 106210 Coloboma of optic nerve, 120430 Coloboma, ocular, 120200

				Foveal hypoplasia 1, 136520 Keratitis, 148190 Optic nerve hypoplasia, 165550 Peters anomaly, 604229 ?Morning glory disc anomaly, 120430
PAX7	115.6	99%	99%	Rhabdomyosarcoma 2, alveolar, 268220
PAX9	254.3	99%	98%	Tooth agenesis, selective, 3, 604625
PITX2	155.7	99%	97%	Axenfeld-Rieger syndrome, type 1, 180500 Iridogoniodysgenesis, type 2, 137600 Peters anomaly, 604229 Ring dermoid of cornea, 180550
PLCB4	147.9	99%	95%	Auriculocondylar syndrome 2, 614669
POLR1C	124.8	99%	95%	Leukodystrophy, hypomyelinating, 11, 616494 Treacher Collins syndrome 3, 248390
POLR1D	196.1	100%	100%	Treacher Collins syndrome 2, 613717
PORCN	145.4	100%	99%	Focal dermal hypoplasia, 305600
PTCH1	138.6	98%	96%	Basal cell carcinoma, somatic, 605462 Basal cell nevus syndrome, 109400 Holoprosencephaly-7, 610828
PTH1R	115.5	99%	99%	Chondrodysplasia, Blomstrand type, 215045 Eiken syndrome, 600002 Failure of tooth eruption, primary, 125350 Metaphyseal chondrodysplasia, Murk Jansen type, 156400
PVRL1	163	100%	99%	Cleft lip/palate-ectodermal dysplasia syndrome, 225060 Orofacial cleft 7, 225060
RAB23	121.6	99%	98%	Carpenter syndrome, 201000
RAD21	97.7	99%	96%	Cornelia de Lange syndrome 4, 614701
RECQL4	150	98%	97%	Baller-Gerold syndrome, 218600 RAPADILINO syndrome, 266280 Rothmund-Thomson syndrome, 268400
RUNX2	106.2	74%	74%	Cleidocranial dysplasia, 119600 Cleidocranial dysplasia, forme fruste, dental anomalies only, 119600 Cleidocranial dysplasia, forme fruste, with brachydactyly, 119600 Metaphyseal dysplasia with maxillary hypoplasia with or without brachydactyly, 156510
SALL1	147.9	99%	98%	Townes-Brocks branchiootorenal-like syndrome, 107480



				Townes-Brocks syndrome, 107480
SALL4	154.6	98%	96%	Duane-radial ray syndrome, 607323 IVIC syndrome, 147750
SATB2	120.1	98%	93%	Glass syndrome, 612313
SEMA3E	167.9	99%	98%	?CHARGE syndrome, 214800
SF3B4	91.8	99%	95%	Acrofacial dysostosis 1, Nager type, 154400
SH3BP2	120.1	91%	90%	Cherubism, 118400
SHH	110.4	98%	94%	Holoprosencephaly-3, 142945 Microphthalmia with coloboma 5, 611638 Schizencephaly, 269160 Single median maxillary central incisor, 147250
SIX1	121.1	99%	96%	Brachiootic syndrome 3, 608389 Deafness, autosomal dominant 23, 605192
SIX3	157.3	99%	96%	Holoprosencephaly-2, 157170 Schizencephaly, 269160
SKI	90.1	98%	95%	Shprintzen-Goldberg syndrome, 182212
SMC1A	120	100%	99%	Cornelia de Lange syndrome 2,300590
SMC3	95.1	93%	86%	Cornelia de Lange syndrome 3, 610759
SMOC2	119.4	97%	92%	Dentin dysplasia, type I, with microdontia and misshapen teeth, 125400
SNAI2	151.2	100%	99%	Piebaldism, 172800 Waardenburg syndrome, type 2D, 608890
SOX10	80.4	97%	93%	PCWH syndrome, 609136 Waardenburg syndrome, type 2E, with or without neurologic involvement, 611584 Waardenburg syndrome, type 4C, 613266
SOX6	123.1	99%	97%	No OMIM phenotype Developmental delay and spinal syrinx (Scott (2014) J Child Neurol 29, NP164) Dystonia, dopa-responsive (Ebrahimi-Fakhari (2015) Pediatr Neurol 52,115) ?Craniosynostosis (Tagariello (2006) J Med Genet 43,534)
SPECC1L	172.6	100%	100%	Opitz GBBB syndrome, type II, 145410 ?Facial clefting, oblique, 1, 600251
SUMO1	17.9	56%	36%	Orofacial cleft 10, 613705
TBX22	138.3	99%	96%	Cleft palate with ankyloglossia, 303400 ?Abruzzo-Erickson syndrome, 302905
TCF12	168	100%	99%	Craniosynostosis 3, 615314

TCOF1	102.6	99%	97%	Treacher Collins syndrome 1, 154500
TFAP2A	138	100%	99%	Branchiooculofacial syndrome, 113620
TGFBR1	213.8	95%	93%	Loeys-Dietz syndrome 1, 609192 {Multiple self-healing squamous epithelioma, susceptibility to}, 132800
TGFBR2	215.3	100%	100%	Colorectal cancer, hereditary nonpolyposis, type 6, 614331 Esophageal cancer, somatic, 133239 Loeys-Dietz syndrome 2, 610168
TGIF1	151.6	99%	99%	Holoprosencephaly-4, 142946
TP63	217.6	100%	100%	ADULT syndrome, 103285 Ectrodactyly, ectodermal dysplasia, and cleft lip/palate syndrome 3, 604292 Hay-Wells syndrome, 106260 Limb-mammary syndrome, 603543 Orofacial cleft 8, 129400 Rapp-Hodgkin syndrome, 129400 Split-hand/foot malformation 4, 605289
TRAF6	105.9	96%	88%	No OMIM phenotype Ectodermal dysplasia, hypohidrotic (Wisniewski (2012) Br J Dermatol 166,1353)
TSHZ1	173.3	98%	98%	Aural atresia, congenital, 607842
TWIST1	143	95%	86%	Craniosynostosis, type 1, 123100 Robinow-Sorauf syndrome, 180750 Saethre-Chotzen syndrome with eyelid anomalies, 101400 Saethre-Chotzen syndrome, 101400
UBB	71.7	100%	99%	Cleft palate, isolated, 119540
VAX1	61.3	89%	79%	?Microphthalmia, syndromic 11, 614402
WDR19	153.5	99%	97%	Nephronophthisis 13, 614377 Senior-Loken syndrome 8, 616307 ?Cranioectodermal dysplasia 4, 614378 ?Short-rib thoracic dysplasia 5 with or without polydactyly, 614376
WDR35	167.2	98%	96%	Cranioectodermal dysplasia 2, 613610 Short-rib thoracic dysplasia 7 with or without polydactyly, 614091
WDR72	161.7	99%	97%	Amelogenesis imperfecta, type IIA3, 613211
WNT10A	114.7	99%	98%	Odontoonychodermal dysplasia, 257980 Schopf-Schulz-Passarge syndrome, 224750 Tooth agenesis, selective, 4, 150400
ZEB2	181.5	100%	99%	Mowat-Wilson syndrome, 235730

ZIC2	111.1	89%	79%	Holoprosencephaly-5, 609637
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*Gene symbols used follow HGNC guidelines: Gray KA, Yates B, Seal RL, Wright MW, Bruford EA. Nucleic Acids Res. 2015 Jan;43(Database issue):D1079-85.*

*Median Coverage describes the average number of reads seen across 50 exomes.*

*% 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.*

*Genes with Median Coverage and % Covered 10x/20x denoting NC are non-coding genes for which coverage statistics could not be generated.*

*OMIM release used for OMIM disease identifiers and descriptions : October 1st, 2016.*

*This list is accurate for panel versions DG 2.7 and DG 2.8 From DG 2.7 to DG 2.8 no changes were made to the content of the gene panels.*

*Ad 1. "No OMIM phenotype" signifies a gene without a current OMIM association Ad 2. OMIM phenotype descriptions between {} signify risk factors*

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