Skeletal Dysplasias

Precision Panel

Overview

Skeletal Dysplasias, also known as osteochondrodysplasias, are a clinically and phenotypically heterogeneous group of more than 450 inherited disorders characterized by abnormalities mainly of cartilage and bone growth although they can also affect muscle, tendons and ligaments, resulting in abnormal shape and size of the skeleton and disproportion of long bones, spine and head. They differ in natural histories, prognoses, inheritance patterns and physiopathologic mechanisms. They range in severity from those that are embryonically lethal to those with minimum morbidity. Approximately 5% of children with congenital birth defects have skeletal dysplasias. Until recently, the diagnosis of skeletal dysplasia relied almost exclusively on careful phenotyping, however, the advent of genomic tests has the potential to make a more accurate and definite diagnosis based on the suspected clinical diagnosis. The 4 most common skeletal dysplasias are thanatophoric dysplasia, achondroplasia, osteogenesis imperfecta and achondrogenesis. The inheritance pattern of skeletal dysplasias is variable and includes autosomal dominant, recessive and X-linked.

The Igenomix Skeletal Dysplasias Precision Panel can be used to make a directed and accurate differential diagnosis of skeletal abnormalities ultimately leading to a better management and prognosis of the disease. It provides a comprehensive analysis of the genes involved in this disease using next-generation sequencing (NGS) to fully understand the spectrum of relevant genes involved.

Indications

The Igenomix Skeletal Dysplasias Precision Panel is indicated for those patients with a suspected clinical diagnosis of skeletal dysplasia presenting with the following manifestations:

- Family history of skeletal dysplasia
- Multiple spontaneous abortions or stillbirths in a family
- Maternal hydramnios (excess amniotic fluid during pregnancy)
- Fetal hydrops (fetal generalized edema)
- Disproportionate short stature
- Intellectual disability
- Disproportionately large head
- Other associated manifestations
    - Ocular: Cataracts, myopia
    - Oral cavity: Bifid uvula, cleft palate
    - Central Nervous System (CNS): intracranial pathologic processes, neurologic impairment

- Skin: redundant skin folds, acanthosis nigricans
- Polydactyly
- Nails: Hypoplastic nails
- Joints: Multiple join dislocations
- Long bone fractures
- Heart: atrial septal defect, patent ductus arteriosus, transposition of great vessels

Clinical Utility

The clinical utility of this panel is:

- The genetic and molecular confirmation for an accurate clinical diagnosis of a symptomatic patient.
- Early initiation of treatment with a multidisciplinary team that includes supportive treatment in the form of medical care, early surgical care, rehabilitation and physical therapy.
- Prenatal detection of skeletal dysplasias for a directed obstetric and perinatal treatment of affected infants.
- Combining phenotypic and genotypic data to improve diagnostic rate of these patients in the target population.
- Risk assessment of asymptomatic family members according to the mode of inheritance.

Genes & Diseases

GENE	OMIM DISEASES	INHERITANCE*	% GENE COVERAGE (20X)	HGMD**
ABCC9	Acromegaloid Facial Appearance Syndrome, Familial Atrial Fibrillation, Familial, Brugada Syndrome, Dilated Cardiomyopathy, Hypertrichosis-Acromegaloid Facial Appearance Syndrome, Hypertrichotic Osteochondrodysplasia,	AD	100%	51 of 51
ACAN	Osteochondritis Dissecans, Short Stature And Early-onset Osteoarthritis, Spondyloepimetaphyseal Dysplasia Aggrecan Type, Spondyloepiphyseal Dysplasia Kimberley Type	AD,AR	86.19%	63 of 65
ACP5	Combined Immunodeficiency With Autoimmunity And Spondylometaphyseal Dysplasia, Spondyloenchondrodysplasia	AR	100%	27 of 28
ACTB	Baraitser-Winter Cerebrofrontofacial Syndrome, Baraitser-Winter Syndrome, Becker Nevus Syndrome, Developmental Malformations-Deafness-Dystonia Syndrome	AD	100%	40 of 40
ACTG1	Baraitser-Winter Cerebrofrontofacial Syndrome, Autosomal Dominant Deafness	AD	98.59%	55 of 55
AFF4	Chops Syndrome, Cognitive Impairment-Coarse Facies-Heart Defects, Obesity-Pulmonary Involvement, Short Stature-Skeletal Dysplasia Syndrome	AD	99.42%	6 of 6
AIFM1	Combined Oxidative Phosphorylation Deficiency, Cowchock Syndrome, X-linked Cowck Deafness, Leukoencephalopathy-Spondylometaphyseal Dysplasia Syndrome, Severe X-linked Mitochondrial Encephalomyopathy, Spondyloepimetaphyseal Dysplasia, X-linked Charcot-Marie-Tooth Disease Type 4	X,XR,G	100%	NA of NA
AKT1	Breast Cancer, Colorectal Cancer, Cowden Syndrome, Meningioma, Proteus Syndrome	AD	100%	6 of 6
ALDH3A2	Sjogren-Larsson Syndrome	AR	96%	119 of 119
ALG9	ALG9-CDG Congenital Disorder Of Glycosylation Type II, Polycystic Kidney Disease Potter Type I	AR	99.99%	6 of 6
ANAPC1	Rothmund-Thomson Syndrome Type 1	AR	86.31%	3 of 4
ANKH	Chondrocalcinosis, Craniometaphyseal Dysplasia, Autosomal Dominant Familial Calcium Pyrophosphate Deposition	AD	100%	19 of 19
ANOS1	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism	X,XR,G	96.86%	NA of NA
ARSB	Mucopolysaccharidosis Type VI	AR	99.83%	217 of 220
B3GALT6	Ehlers-Danlos Syndrome Progeroid Type 2, Spondyloepimetaphyseal Dysplasia With Joint Laxity	AR	65.09%	24 of 39
B4GALT7	B4GALT7-Related Spondylodysplastic Ehlers-Danlos Syndrome	AR	99.92%	11 of 11
BGN	Meester-Loeys Syndrome, X-linked Spondyloepimetaphyseal Dysplasia	X,XR,G	99.87%	NA of NA
BMPR1B	Acromesomelic Dysplasia Grebe Type, Brachydactyly Type A1, A2, C, D, Aplasia-Complex Brachydactyly Syndrome	AD,AR	100%	33 of 34
CANT1	Desbuquois Dysplasia, Desbuquois Syndrome, Multiple Epiphyseal Dysplasia	AR	99.98%	29 of 30
CCDC141	Hypogonadotropic Hypogonadism Without Anosmia, Kallmann Syndrome	AR	99.70%	1 of 1
CDH3	Eem Syndrome, Hypotrichosis With Juvenile Macular Degeneration, Congenital Hypotrichosis With Juvenile Macular Dystrophy	AR	95%	34 of 36

CDKN1C	Beckwith-Wiedemann Syndrome, IMAGE Syndrome, Intrauterine Growth Restriction-Short Stature-Early Adult-Onset Diabetes Syndrome, Metaphyseal Dysplasia, Adrenal Hypoplasia Congenita, And Genital Anomalies	AD	73.58%	55 of 76
CEP120	Jeune Syndrome, Joubert Syndrome, Short-Rib Thoracic Dysplasia With Or Without Polydactyly	AR	99.80%	9 of 9
CFAP410	Amyotrophic Lateral Sclerosis, Cone Rod Dystrophy, Retinal Dystrophy With Or Without Macular Staphyloma, Axial Spondylometaphyseal Dysplasia	AR	na	na
CHD7	CHARGE Syndrome, Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism, Omenn Syndrome	AD	96.25%	823 of 896
CHST3	CHST3-Related Skeletal Dysplasia, Multiple Joint Dislocations, Short Stature, Craniofacial Dysmorphism With Or Without Congenital Heart Defects, Spondyloepiphyseal Dysplasia With Congenital Joint Dislocations	AR	99.97%	38 of 38
COL10A1	Metaphyseal Chondrodysplasia Schmid Type	AD	96.18%	55 of 55
COL11A1	Autosomal Dominant Myopia-Midfacial Retrusion-Sensorineural Hearing Loss, Rhizomelic Dysplasia Syndrome, Autosomal Recessive Stickler Syndrome, Autosomal Dominant Deafness, Fibrochondrogenesis, Marshall Syndrome, Stickler Syndrome Type 2	AD,AR	100%	104 of 106
COL11A2	Autosomal Dominant Otospondylomegaepiphyseal Dysplasia, Autosomal Dominant Deafness, Fibrochondrogenesis, Stickler Syndrome Type 3	AD,AR	99.98%	58 of 58
COL1A1	Arthrochalasia, Ehlers-Danlos Syndrome, Caffey Disease, Dermatofibrosarcoma Protuberans, Ehlers-Danlos Syndrome Type 7, Osteogenesis Imperfecta Type I, IIa, III, IV, Osteoporosis	AD	99.98%	1156 of 1159
COL1A2	Arthrochalasia Ehlers-Danlos Syndrome, Cardiac-Valvular Ehlers-Danlos Syndrome, Osteogenesis Imperfecta, Type IIa, III, IV, Osteoporosis	AD,AR	100%	576 of 581
COL2A1	Achondrogenesis Type 2, Autosomal Dominant Otospondylomegaepiphyseal Dysplasia, Avascular Necrosis Of Femoral Head, Primary Czech Dysplasia Metatarsal Type, Dysspondyloenchondromatosis, Epiphyseal Dysplasia Multiple With Myopia And Conductive Deafness, Familial Avascular Necrosis Of Femoral Head, Kniest Dysplasia, Legg-Calve-Perthes Disease, Multiple Epiphyseal Dysplasia Beighton Type, Osteoarthritis With Mild Chondrodysplasia, Platyspondylic Dysplasia Torrance Type, Spondyloepimetaphyseal Dysplasia Congenita Strudwick Type, Stanescu Type, Spondylometaphyseal Dysplasia 'Corner Fracture' Type, Spondyloperipheral Dysplasia, Short Ulna Syndrome, Stickler Syndrome Type 1	AD,MU	100%	583 of 583
COL3A1	Acrogeria, Ehlers-Danlos Syndrome Type IV, Autosomal Dominant Familial Cerebral Saccular Aneurysm, Polymicrogyria With Or Without Vascular-Type Ehlers-Danlos Syndrome, Vascular Ehlers-Danlos Syndrome	AD,AR	100%	676 of 676
COL9A1	Autosomal Recessive Stickler Syndrome, Multiple Epiphyseal Dysplasia, Multiple Epiphyseal Dysplasia Due To Collagen 9 Anomaly, Stickler Syndrome Type IV	AD,AR	99.98%	8 of 8
COL9A2	Autosomal Recessive Stickler Syndrome, Multiple Epiphyseal Dysplasia, Multiple Epiphyseal Dysplasia Due To Collagen 9 Anomaly, Stickler Syndrome, Type V	AD,AR	100%	16 of 16
COL9A3	Autosomal Recessive Stickler Syndrome, Multiple Epiphyseal Dysplasia, Multiple Epiphyseal Dysplasia Due To Collagen 9 Anomaly	AD	99.98%	20 of 20
COMP	Multiple Epiphyseal Dysplasia, Multiple Epiphyseal Dysplasia Type 1, Pseudoachondroplasia	AD	99.71%	189 of 189
CTSA	Galactosialidosis, Neuraminidase Deficiency With Beta-Galactosidase Deficiency	AR	100%	40 of 40
CTSK	Pycnodysostosis	AR	99.97%	59 of 59
CWC27	Retinitis Pigmentosa With Or Without Skeletal Anomalies	AR	99.77%	8 of 8
DCC	Colorectal Cancer, Esophageal Cancer, Familial Congenital Mirror Movements, Familial Horizontal Gaze Palsy With Progressive Scoliosis And Impaired Intellectual Development, Kallmann Syndrome	AD,AR	94%	39 of 39
DCHS1	Cerebrofacioarticular Syndrome, Mitral Valve Prolapse, Van Maldergem Syndrome	AD,AR	99.69%	30 of 30
DDR2	Spondylometaepiphyseal Dysplasia, Short Limb-hand Type, Warburg-Cinotti Syndrome	AD,AR	100%	13 of 13
DDRGK1	Spondyloepimetaphyseal Dysplasia, Shohat Type	AR	99.94%	1 of 1
DMP1	Autosomal Recessive Hypophosphatemic Rickets	AR	99.89%	11 of 11
DNAJC21	Bone Marrow Failure Syndrome, Shwachman-Diamond Syndrome	AR	99.83%	12 of 12
DUSP6	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism	AD,AR	99.36%	4 of 4
DYM	Dyggve-Melchior-Clausen Disease, Smith-Mccort Dysplasia	AR	90%	37 of 37
DYNC2H1	Jeune Syndrome, Short Rib-Polydactyly Syndrome Verma-Naumoff Type, Short-Rib Thoracic Dysplasia With Or Without Polydactyly	AR,MU,D	99.78%	214 of 221
DYNC2I1	Jeune Syndrome, Short Rib-Polydactyly Syndrome Verma-Naumoff Type, Short-Rib Thoracic Dysplasia With Or Without Polydactyly	AR	97.76%	14 of 14
DYNC2I2	Jeune Syndrome, Short Rib-Polydactyly Syndrome, Verma-Naumoff Type, Short-Rib Thoracic Dysplasia With Or Without Polydactyly	AR	99.54%	23 of 23
DYNC2LI1	Ellis Van Creveld Syndrome, Jeune Syndrome, Short-Rib Thoracic Dysplasia With Polydactyly	AR	91.58%	16 of 16
EIF2AK3	Multiple Epiphyseal Dysplasia With Early-Onset Diabetes Mellitus, Wolcott-Rallison Syndrome	AR	99.30%	89 of 89
ENPP1	Generalized Arterial Calcification Of Infancy, Autosomal Recessive Hypophosphatemic Rickets, Cole Disease, Noninsulin-Dependent Diabetes Mellitus, Obesity, Pseudoxanthoma Elasticum	AD,AR,MU,P	96.59%	73 of 75
ERF	Chitayat Syndrome, Crouzon Disease, Familial Lambdoid Synostosis, Isolated Cloverleaf Skull Syndrome	AD	99.73%	31 of 31
EXOC6B	Spondyloepimetaphyseal Dysplasia With Joint Laxity, Spondyloepimetaphyseal Dysplasia With Joint Laxity Type 3	AR	99.99%	2 of 3
EXTL3	Immunoskeletal Dysplasia With Neurodevelopmental Abnormalities, Skeletal Dysplasia-T-Cell Immunodeficiency Developmental Delay Syndrome	AR	99.99%	10 of 10
FAM111A	Autosomal Dominant Kenny-Caffey Syndrome, Gracile Bone Dysplasia	AD	99.47%	9 of 10
FAT4	Cerebrofacioarticular Syndrome, Hennekam Lymphangiectasia-Lymphedema Syndrome, Van Maldergem Syndrome	AR	99.80%	41 of 41
FEZF1	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome	AR	99.95%	3 of 3
FGF17	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism	AD,AR	99.98%	8 of 8
FGF8	Alobar Holoprosencephaly, Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Lobar Holoprosencephaly, Microform Holoprosencephaly, Midline Interhemispheric Variant Of Holoprosencephaly, Normosmic Congenital Hypogonadotropic Hypogonadism, Septopreoptic Holoprosencephaly	AD	98.36%	38 of 38
FGFR1	Encephalocraniocutaneous Lipomatosis, Hartsfield Syndrome, Isolated Trigonocephaly, Jackson-Weiss Syndrome, Kallmann Syndrome, Lobar Holoprosencephaly, Microform Holoprosencephaly, Normosmic Congenital Hypogonadotropic Hypogonadism, Oligodontia, Osteoglophonic Dysplasia,	AD	100%	279 of 280

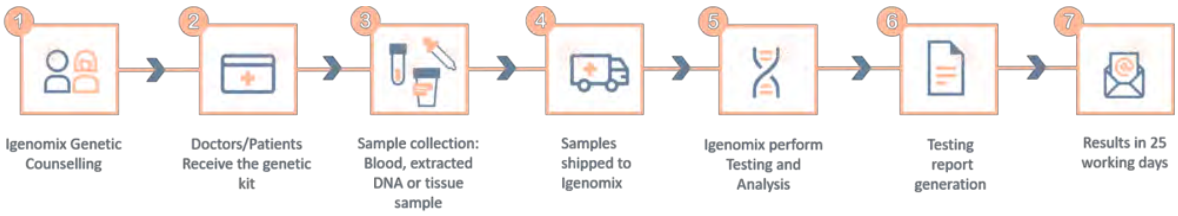
	Pfeiffer Syndrome, Semilobar Holoprosencephaly, Septo-Optic Dysplasia Spectrum, Nonsyndromic Trigonocephaly			
FGFR3	Severe Achondroplasia With Developmental Delay And Acanthosis Nigricans, Bladder Cancer, Camptodactyly-Tall Stature-Scoliosis-Hearing Loss Syndrome, Cervical Cancer, Colorectal Cancer, Crouzon Syndrome With Acanthosis Nigricans, Epidermal Nevus, Hypochondroplasia, Isolated Brachycephaly, Isolated Plagiocephaly, Lacrimoauriculodentodigital Syndrome, Muenke Syndrome, Saethre-Chotzen Syndrome, Severe Achondroplasia-Developmental Delay-Acanthosis Nigricans Syndrome, Testicular Tumor, Thanatophoric Dysplasia Type 1 And 2	AD,AR	99.89%	77 of 78
FLNA	X-linked Cardiac Valvular Dysplasia, Congenital Short Bowel Syndrome, Frontometaphyseal Dysplasia, X-linked Dominant Periventricular Heterotopia, Neuronal Intestinal Pseudoobstruction, Melnick-Needles Syndrome, Otopalatodigital Syndrome Type 1, 2, Periventricular Nodular Heterotopia, Terminal Osseous Dysplasia, X-linked Ehlers-Danlos Syndrome	X,XR,XD,G	100%	NA of NA
FLNB	Atelosteogenesis Type I and Type III, Boomerang Dysplasia, Larsen Syndrome, Spondylocarpotarsal Synostosis Syndrome	AD,AR	100%	124 of 124
FLRT3	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome	AD	99.98%	7 of 7
FN1	Fibronectin Glomerulopathy, Spondylometaphyseal Dysplasia 'Corner Fracture' Type	AD	100%	34 of 34
GDF5	Acromesomelic Dysplasia Grebe Type, Hunter-Thompson Type, Angel-Shaped Phalango-Epiphyseal Dysplasia, Brachydactyly Type A1, Type A2, Type C, Chondrodysplasia Grebe Type, Fibular Aplasia-Complex Brachydactyly Syndrome, Multiple Synostoses Syndrome, Proximal Symphalangism	AD,AR	99.48%	48 of 51
GJA1	Alopecia Congenita With Keratosis Palmoplantaris, Atrioventricular Septal Defect, Autosomal Dominant Palmoplantar Keratoderma And Congenital Alopecia, Craniometaphyseal Dysplasia, Erythrokeratodermia Variabilis,,hypoplastic Left Heart Syndrome, Hypoplastic Left Heart Syndrome, Oculodentodigital Dysplasia, Syndactyly Type 3	AD,AR,MU,O	100%	119 of 119
GLI3	Acrocallosal Syndrome, Greig Cephalopolysyndactyly Syndrome, Congenital Hypothalamic Hamartoma Syndrome, Pallister-hall Syndrome, Postaxial Polydactyly, Preaxial Polydactyly, Tibial Hemimelia	AD,AR	100%	231 of 231
GNAS	ACTH-Independent Macronodular Adrenal Hyperplasia, Albright Hereditary Osteodystrophy, Cushing Syndrome Due To Macronodular Adrenal Hyperplasia, Mazabraud Syndrome, McCune-Albright Syndrome, Progressive Osseous, Pseudohypoparathyroidism Type 1A, 1B, 1C Type 1c	AD	99.95%	263 of 273
GPX4	Spondylometaphyseal Dysplasia Sedaghatian Type	AR	79.72%	3 of 3
HBB	Alpha-Thalassemia, Beta-thalassemia, Heinz Body Anemias, Hemoglobin C-Beta-Thalassemia Syndrome, Hemoglobin E-beta-thalassemia Syndrome, Hereditary Persistence Of Fetal Hemoglobin-Beta-Thalassemia Syndrome, Sickle Cell Anemia	AD,AR	100%	753 of 789
HDAC6	Chondrodysplasia With Platyspondyly, Distinctive Brachydactyly, Hydrocephaly and Microphthalmia, X-linked Dominant Chondrodysplasia, Chassaing-Lacombe Type	X,XD,G	100%	NA of NA
HESX1	Combined Pituitary Hormone Deficiencies, Genetic Forms, Hypothyroidism, Kallmann Syndrome, Pituitary Stalk Interruption Syndrome, Septo-Optic Dysplasia Spectrum	AD,AR	100%	26 of 26
HS6ST1	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism	AD	99.97%	8 of 8
HSPA9	Autosomal Dominant Sideroblastic Anemia, Even-Plus Syndrome	AD,AR	99.72%	14 of 14
HSPG2	Dyssegmental Dysplasia Silverman-Handmaker Type, Schwartz-jJmpel Syndrome	AR	99.41%	68 of 69
IARS2	Cataract-Growth Hormone Deficiency-Sensory Neuropathy-Sensorineural Hearing Loss-Skeletal Dysplasia Syndrome	AR	99.95%	11 of 11
IDUA	Hurler Syndrome, Hurler-Scheie Syndrome, Scheie Syndrome	AR	99.73%	287 of 292
IFT140	Jeune Syndrome, Leber Congenital Amaurosis, Retinitis Pigmentosa, Short-Rib Thoracic Dysplasia With Or Without Polydactyly	AR	99.97%	81 of 81
IFT172	Bardet-Biedl Syndrome, Jeune Syndrome, Retinitis Pigmentosa, Short-Rib Thoracic Dysplasia With Or Without Polydactyly	AR	100%	37 of 37
IFT80	Asphyxiating Thoracic Dystrophy, Jeune Syndrome, Short Rib-Polydactyly Syndrome, Verma-Naumoff Type	AR	99.96%	16 of 16
IHH	Acrocapitofemoral Dysplasia, Brachydactyly Type A1	AD,AR	99.39%	28 of 29
IL17RD	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome	AD,AR	99.95%	17 of 17
KCNJ8	Brugada Syndrome, Hypertrichotic Osteochondrodysplasia, Cantu Type		100%	8 of 8
KIF22	Spondyloepimetaphyseal Dysplasia With Multiple Dislocations	AD	100%	4 of 4
KIF7	Acrocallosal Syndrome, Hydrolethalus Syndrome, Macrocephaly With Multiple Epiphyseal Dysplasia And Distinctive Facies, Orofaciodigital Syndrome Type 6	AR	94.91%	47 of 50
KISS1R	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism, Central Precocious Puberty	AD,AR	99.41%	42 of 43
KRAS	Aplasia Cutis Congenita With Epibulbar Dermoids, Arteriovenous Malformation Of The Brain, Somatic,bladder Cancer, Breast Cancer, Cardiofaciocutaneous Syndrome, Encephalocraniocutaneous Lipomatosis, Familial Pancreatic Carcinoma, Gastric Cancer, Acute Myeloid Leukemia, Linear Nevus Sebaceus Syndrome, Lung Cancer, Lynch Syndrome, Noonan Syndrome, Pancreatic Cancer, RAS-associated Autoimmune Lymphoproliferative Syndrome Type IV, Schimmelpenning-Feuerstein-Mims Syndrome, Toriello-Lacassie-Droste Syndrome	AD	100%	38 of 38
LBR	Greenberg Dysplasia, Hydrops-Ectopic Calcification-Moth-Eaten Skeletal Dysplasia, Pelger-Huet Anomaly, Reynolds Syndrome	AD,AR	99.98%	34 of 34
LEMD3	12q14 Microdeletion Syndrome, Buschke-Ollendorff Syndrome, Isolated Osteopoikilosis, Melorheostosis With Osteopoikilosis	AD	99.06%	30 of 33
LIFR	Stuve-Wiedemann Syndrome	AR	99.81%	33 of 33
LMX1B	9q33.3q34.11 Microdeletion Syndrome, Nail-Patella Syndrome, Nail-Patella-Like Renal Disease	AD	100%	191 of 191
LONP1	Codas Syndrome	AR	99.84%	21 of 21
LOXL3	Autosomal Recessive Stickler Syndrome		99.97%	7 of 7
LTBP3	Acromicric Dysplasia, Geleophysic Dysplasia, Platyspondyly With Amelogenesis Imperfecta	AD,AR	97.67%	22 of 23
MAB21L2	Syndromic Microphthalmia	AD,AR	99.97%	8 of 8
MATN3	Multiple Epiphyseal Dysplasia, Osteoarthritis Of Distal Interphalangeal Joints, Spondyloepimetaphyseal Dysplasia, Matrilin-3 Related	AD,AR	86.16%	24 of 25
MBTPS1	Spondyloepiphyseal Dysplasia, Kondo-Fu Type	AR	99.99%	5 of 5
MMP13	Metaphyseal Anadysplasia, Metaphyseal Chondrodysplasia, Spahr Type, Spondyloepimetaphyseal Dysplasia, Missouri Type, Spondyloepimetaphyseal Dysplasia Type II	AD,AR	100%	10 of 10
MYSM1	Bone Marrow Failure Syndrome, Congenital Progressive Bone Marrow Failure-B-Cell Immunodeficiency-Skeletal Dysplasia Syndrome	AR	98.50%	4 of 4

NANS	Spondyloepimetaphyseal Dysplasia, Genevieve Type	AR	99.97%	12 of 12
NEU1	Congenital Sialidosis Type 2, Juvenile Sialidosis Type 2, Neuraminidase Deficiency, Sialidosis Type 1	AR	100%	68 of 68
NKX3-2	Spondylo-Megaepiphyseal-Metaphyseal Dysplasia	AR	99.02%	5 of 5
NLRC4	Autoinflammation With Infantile Enterocolitis, Familial Cold Autoinflammatory Syndrome	AD	99.54%	15 of 15
NLRP3	Cinca Syndrome, Autosomal Dominant Deafness, Familial Cold Inflammatory Syndrome, Familial Cold Urticaria, Keratoendotheliitis Fugax Hereditaria, Muckle-Wells Syndrome	AD	100%	152 of 152
NOTCH2	Acroosteolysis Dominant Type, Acroosteolysis With Osteoporosis And Changes In Skull And Mandible, Alagille Syndrome	AD	99.88%	91 of 91
NPR2	Acromesomelic Dysplasia, Maroteaux Type, Epiphyseal Chondrodysplasia, Miura Type, Short Stature With Nonspecific Skeletal Abnormalities	AD,AR	100%	81 of 81
NSMF	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism	AD	99.69%	11 of 11
P4HB	Cole-Carpenter Syndrome	AD	94.97%	13 of 13
PAM16	Chondrodysplasia, Megarbane-Dagher-Melki Type	AR	41%	2 of 2
PAPSS2	Spondyloepimetaphyseal Dysplasia, Pakistani Type	AR	99.97%	27 of 27
PCYT1A	Leber Congenital Amaurosis, Spondylometaphyseal Dysplasia With Cone-Rod Dystrophy Syndrome	AR	99.98%	22 of 22
PEX1	Deafness-Enamel Hypoplasia-Nail Defects Syndrome, Sensorineural Hearing Loss With Enamel Hypoplasia And Nail Defects, Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder, Zellweger Syndrome	AR	97.02%	126 of 134
PEX10	Autosomal Recessive Ataxia Due To PEX10 Deficiency, Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder 6A, Zellweger Syndrome	AR	99.76%	29 of 32
PEX11B	Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder, Zellweger Syndrome	AR	90.29%	7 of 7
PEX12	Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder 3A (Zellweger), Refsum Disease Infantile Form, Zellweger Syndrome	AR	100%	38 of 38
PEX13	Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder 11A (Zellwege), Peroxisome Biogenesis Disorder 11B, Zellweger Syndrome	AR	99.98%	11 of 12
PEX14	Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder 13A (Zellweger), Zellweger Syndrome	AR	100%	4 of 4
PEX16	Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder 8A (Zellweger), 8B, Zellweger Syndrome	AR	100%	17 of 17
PEX19	Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder 12A (Zellweger), Zellweger Syndrome	AR	100%	5 of 5
PEX2	Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder 5A (Zellweger), 5B, Zellweger Syndrome	AR	99.89%	17 of 17
PEX26	Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder 7A (Zellweger), 7B, Zellweger Syndrome	AR	100%	29 of 29
PEX3	Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder 10A (Zellweger), 10B, Zellweger Syndrome	AR	100%	9 of 9
PEX5	Adrenoleukodystrophy, Cerebrohepatorenal Syndrome, Variant Types, Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Rhizomelic Chondrodysplasia Punctata Type 5, Zellweger Syndrome	AR	100%	12 of 12
PEX6	Autosomal Recessive Spinocerebellar Ataxia-Blindness-Deafness Syndrome, Deafness-Enamel Hypoplasia-Nail Defects Syndrome, Heimler Syndrome, Infantile Refsum Disease, Neonatal Adrenoleukodystrophy, Peroxisome Biogenesis Disorder 4A (Zellweger), 4B, Zellweger Syndrome	AD,AR	99.94%	105 of 108
PEX7	Peroxisome Biogenesis Disorder 9B, Refsum Disease, Rhizomelic Chondrodysplasia Punctata Type 1	AR	99.21%	47 of 53
PHYH	Refsum Disease	AR	100%	34 of 34
POLE	Colorectal Cancer, Facial Dysmorphism, Immunodeficiency, Livedo And Short Stature, IMAGE Syndrome, Intrauterine Growth Retardation, Metaphyseal Dysplasia Adrenal Hypoplasia Congenita Genital Anomalies And Immunodeficiency, Polymerase Proofreading-Related Adenomatous Polyposis	AD,AR	100%	100 of 100
POLR1C	Hypomyelination-Hypogonadotropic Hypogonadism-Hypodontia Syndrome, Hypomyelinating Leukodystrophy, Mandibulofacial Dysostosis, Autosomal Recessive Treacher Collins Type	AR	99.99%	35 of 35
POLR1D	Treacher Collins Syndrome	AD,AR	100%	23 of 23
POP1	Anauxetic Dysplasia	AR	99.88%	6 of 6
PROK2	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism	AD	100%	20 of 20
PROKR2	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism, Pituitary Stalk Interruption Syndrome, Septo-optic Dysplasia Spectrum	AD	100%	64 of 64
PTEN	Bannayan-Riley-Ruvalcaba Syndrome, Cowden Disease, Hereditary Breast And Ovarian Cancer Syndrome, Juvenile Polyposis Of Infancy, Lhermitte-Duclos Disease, Macrocephaly/Autism Syndrome, Familia Meningioma, Prostate Cancer, Proteus Syndrome, Segmental Outgrowth-Lipomatosis-Arteriovenous Malformation-Epidermal Nevus Syndrome	AD	99.97%	609 of 629
PTH1R	Blomstrand Lethal Chondrodysplasia, Dental Noneruption, Eiken Skeletal Dysplasia, Metaphyseal Chondrodysplasia, Jansen Type, Ollier Disease	AD,AR	100%	48 of 48
RECQL4	Baller-Gerold Syndrome, Rapadilino Syndrome, Rothmund-Thomson Syndrome	AR	96.72%	134 of 135
RMRP	Anauxetic Dysplasia, Cartilage-Hair Hypoplasia, Metaphyseal Dysplasia Without Hypotrichosis, Omenn Syndrome	AR	na	na
RNU4ATAC	Lowry-Wood Syndrome, Microcephalic Osteodysplastic Primordial Dwarfism Types I And III, Microcephalic Osteodysplastic Primordial Dwarfism Type I, Roifman Syndrome	AR	na	na
RPL10	X-linked Mental Retardation, X-linked Intellectual Disability-Cerebellar Hypoplasia-Spondylo-Epiphyseal Dysplasia Syndrome, X-linked Microcephaly-Growth Retardation-Prognathism-Cryptorchidism Syndrome	X,XR,G	100%	NA of NA
RSPRY1	Progressive Spondyloepimetaphyseal Dysplasia-Short Stature-Short Fourth Metatarsals-Intellectual Disability Syndrome, Spondyloepimetaphyseal Dysplasia, Faden-Alkuraya Type	AR	99.98%	4 of 4
RUNX2	Cleidocranial Dysplasia, Metaphyseal Dysplasia With Maxillary Hypoplasia And Brachydactyly	AD	73.67%	189 of 190
SBDS	Aplastic Anemia, Idiopathic Aplastic Anemia, Shwachman-Diamond Syndrome	AR	100%	77 of 79
SEC23A	Craniolenticulosutural Dysplasia	AR	100%	4 of 4
SEC24D	Cole-Carpenter Syndrome	AR	99.97%	14 of 14

SEMA3A	Brugada Syndrome, Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome	AD	100%	29 of 29
SF3B4	Acrofacial Dysostosis, Nager Type, Rodriguez Type, Nager Syndrome	AD	94.86%	33 of 40
SFRP4	Pyle Disease	AR	99.95%	5 of 5
SLC10A7	Short Stature, Amelogenesis Imperfecta And Skeletal Dysplasia With Scoliosis	AR	99.99%	8 of 8
SLC26A2	Achondrogenesis Type 1B, Atelosteogenesis Type II, Diastrophic Dwarfism, Diastrophic Dysplasia, Multiple Epiphyseal Dysplasia Type 4	AR	99.59%	51 of 56
SLC39A13	Ehlers-Danlos Syndrome Spondylodysplastic Type	AR	100%	9 of 9
SMARCAL1	Immunoosseous Dysplasia, Schimke Type	AR	99.94%	93 of 93
SOX10	Kallmann Syndrome, Peripheral Demyelinating Neuropathy-Central Dysmyelinating Leukodystrophy-Waardenburg Syndrome-Hirschsprung Disease, Waardenburg-Shah Syndrome	AD	99.74%	139 of 147
SPRY4	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism	AD,AR	99.72%	13 of 13
SRP54	Autosomal Dominant Severe Congenital Neutropenia, Shwachman-Diamond Syndrome	AD,AR	99.95%	8 of 8
STAC3	Native American Myopathy	AR	99.98%	5 of 5
TACR3	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism	AR	99.97%	40 of 40
TBXAS1	Ghosal Hematodiaphyseal Dysplasia	AR	100%	6 of 6
TCOF1	Treacher Collins-Franceschetti Syndrome	AD	100%	326 of 327
TGFB1	Camurati-Engelmann Disease, Cystic Fibrosis, Inflammatory Bowel Disease, Immunodeficiency And Encephalopathy	AD,AR	99.75%	24 of 24
TMEM165	Congenital Disorder Of Glycosylation Type IIk	AR	93.69%	4 of 5
TMEM67	Bardet-Biedl Syndrome, Coach Syndrome, Joubert Syndrome, Joubert Syndrome With Hepatic Defect, Meckel Syndrome Type 3, Nephronophthisis, Rhyns Syndrome	AR	96.93%	177 of 179
TONSL	Sponastrime Dysplasia, Spondyloepimetaphyseal Dysplasia	AR	98.76%	36 of 40
TRAPPC2	X-linked Spondyloepiphyseal Dysplasia Tarda	X,XR,G	99.58%	NA of NA
TREM2	Amyotrophic Lateral Sclerosis, Behavioral Variant Of Frontotemporal Dementia, Early-Onset Autosomal Dominant Alzheimer Disease, Nasu-Hakola Disease, Polycystic Lipomembranous Osteodysplasia With Sclerosing Leukoencephalopathy, Progressive Non-fluent Aphasia, Semantic Dementia	AD	100%	55 of 55
TRIP11	Achondrogenesis Type 1A, Odontochondrodysplasia	AR	98.94%	20 of 21
TRPV4	Autosomal Dominant Brachyolmia Autosomal Dominant Congenital Benign Spinal Muscular Atrophy, Primary Avascular Necrosis Of Femoral Head, Brachyrachia, Familial Digital Arthropathy-Brachydactyly, Hereditary Motor And Sensory Neuropathy Type IIC, Nonlethal Dominant Metatropic Dysplasia, Parastremmatic Dwarfism, Scapuloperoneal Spinal Muscular Atrophy, Spondyloepiphyseal Dysplasia, Maroteaux Type, Spondylometaphyseal Dysplasia, Kozlowski Type	AD	100%	88 of 88
TTC21B	Asphyxiating Thoracic Dystrophy, Jeune Syndrome, Nephronophthisis, Joubert Syndrome	AD,AR	100%	67 of 67
TYROBP	Nasu-Hakola Disease, Polycystic Lipomembranous Osteodysplasia With Sclerosing Leukoencephalopathy	AR	100%	12 of 13
UFSP2	Hip Dysplasia, Beukes Type, Spondyloepimetaphyseal Dysplasia, Di Rocco Type	AD	99.83%	3 of 3
VPS33A	Mucopolysaccharidosis-Like Syndrome With Congenital Heart Defects And Hematopoietic Disorders	AR	97.86%	1 of 1
WDR11	Hypogonadotropic Hypogonadism With Or Without Anosmia, Kallmann Syndrome, Normosmic Congenital Hypogonadotropic Hypogonadism, Pituitary Stalk Interruption Syndrome	AD,AR	100%	19 of 19
WDR19	Asphyxiating Thoracic Dystrophy, Cranioectodermal Dysplasia, Jeune Syndrome, Nephronophthisis, Senior-Loken Syndrome,	AR	99.96%	47 of 49
WDR35	Cranioectodermal Dysplasia, Short Rib-Polydactyly Syndrome, Verma-Naumoff Type, Short-Rib Thoracic Dysplasia With Or Without Polydactyly	AR	100%	31 of 33
XYLT1	Desbuquois Dysplasia, Desbuquois Syndrome, Pseudoxanthoma Elasticum	AR	92.61%	19 of 23

*Inheritance: AD: Autosomal Dominant; AR: Autosomal Recessive; X: X linked; XLR: X linked Recessive; Mi: Mitochondrial; Mu: Multifactorial.
**Number of clinically relevant mutations according to HGMD

Methodology



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- Get more information about the test.
- Request your kit.
- Request a pick up of the kit after collecting the sample.

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