MISSION:

To advance research to improve the quality of life for RASopathies families by bringing together families, clinicians and scientists

The RASopathies are a group of rare genetic conditions caused by mutations in genes of the Ras-MAPK pathway. Abnormalities of this pathway have profound effects on development and can cause one of several different syndromes.

These syndromes have many clinical features in common, such as distinct facial features, developmental delays, cardiac defects, growth delays, neurologic issues, and gastrointestinal difficulties. While these individual syndromes are rare, as a group, the RASopathies are among the most common genetic conditions in the world.

- Pilar Magoulas, Genetic Counselor, 2013

PROGRAMS INCLUDE:

- Biennial international symposia bringing together families, clinicians and researchers
- RASopathies research grants
- Networking with RASopathy syndrome family and advocacy organizations, clinicians and researchers
- Webinars covering current critical topics

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A resource and repository for research on syndromes with mutations on the Ras/mitogen activated kinase signaling pathway

RASOPATHIES NETWORK

connect • collaborate • accelerate

Genetic syndromes with mutations on the Ras/mitogen activated protein kinase pathway

Cardiofaciocutaneous syndrome (CFC)

1:150,000 (UK, unpublished) to 1:810,000 (Abe, et al. 2012)

CFC syndrome causes heart issues (pulmonic stenosis and other valve dysplasias, septal defects, hypertrophic cardiomyopathy, rhythm disturbances), distinctive craniofacial appearance, and skin conditions (including xerosis, hyperkeratosis, ichthyosis, keratosis pilaris, ulerythema ophryogenes, eczema, pigmented moles, hemangiomas, and palmoplantar hyperkeratosis). The hair is typically sparse, curly, fine or thick, woolly or brittle; eyelashes and eyebrows may be absent or sparse. Nails may be dystrophic or fast growing. Some form of neurologic and/or cognitive delay (ranging from mild to severe) is seen in all affected individuals. Tumors, mostly acute lymphoblastic leukemia (ALL), have been reported in some individuals.

Costello syndrome (CS)

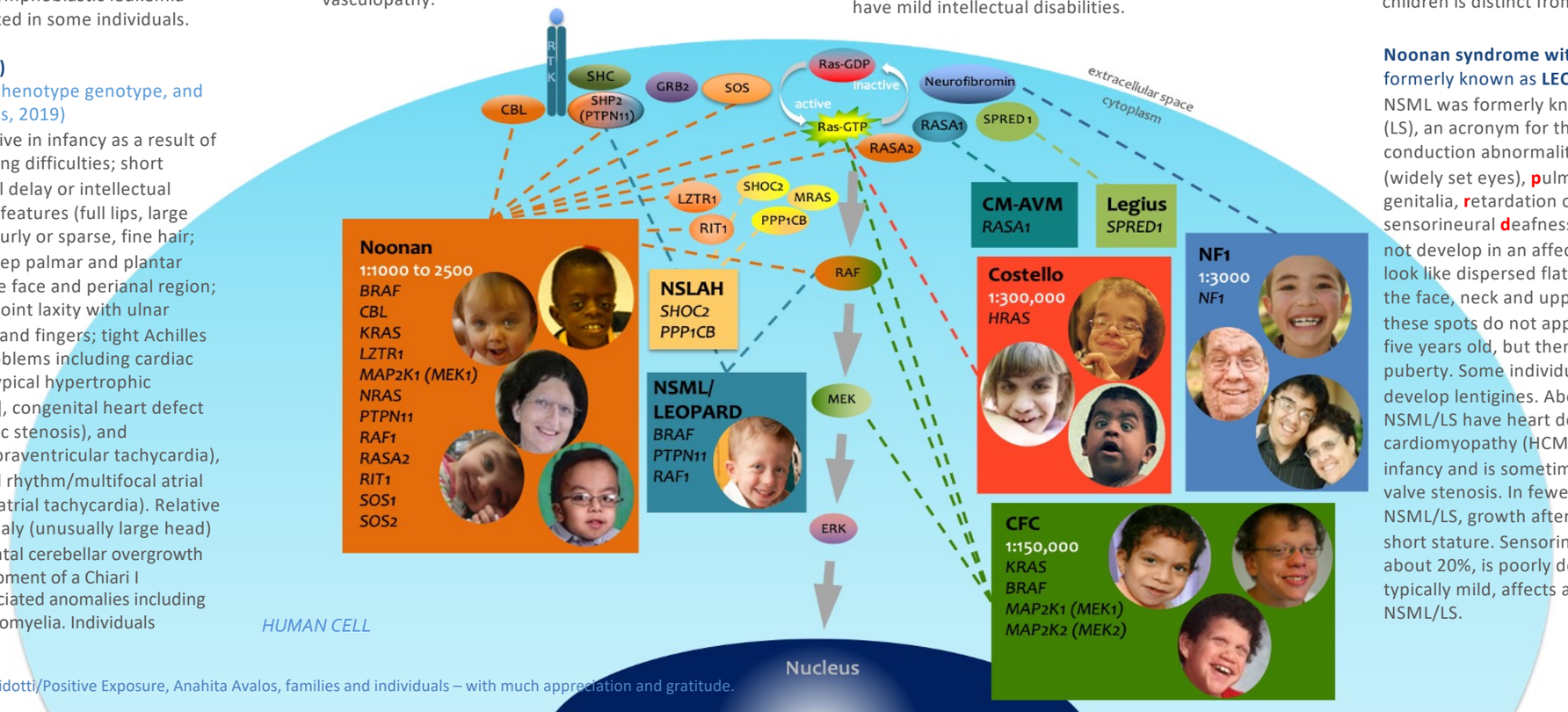
1:300,000 (CS Clinical phenotype genotype, and management guidelines, 2019)

CS causes failure to thrive in infancy as a result of severe post-natal feeding difficulties; short stature; developmental delay or intellectual disability; coarse facial features (full lips, large mouth, full nasal tip); curly or sparse, fine hair; loose, soft skin with deep palmar and plantar creases; skin tags of the face and perianal region; diffuse hypotonia and joint laxity with ulnar deviation of the wrists and fingers; tight Achilles tendons; and heart problems including cardiac hypertrophy (usually typical hypertrophic cardiomyopathy [HCM], congenital heart defect (usually valvar pulmonic stenosis), and arrhythmia (usually supraventricular tachycardia), especially chaotic atrial rhythm/multifocal atrial tachycardia or ectopic atrial tachycardia). Relative or absolute macrocephaly (unusually large head) is common, and postnatal cerebellar overgrowth can result in the development of a Chiari I malformation with associated anomalies including hydrocephalus or syringomyelia. Individuals with Costello syndrome have about a 15% lifetime risk for malignant tumors including rhabdomyosarcoma and neuroblastoma in young children, and transitional cell carcinoma of the bladder in adolescents and young adults.

Neurofibromatosis type 1 (NF1)

1:3,000 (Friedman JM, 2012)

NF1 includes multiple café au lait spots, axillary and inguinal freckling, multiple cutaneous neurofibromas, and iris Lisch nodules. At least 50% of individuals with NF1 have learning disabilities. Less common but potentially more serious issues include plexiform neurofibromas, optic nerve and other central nervous system gliomas, malignant peripheral nerve sheath tumors, scoliosis, tibial dysplasia, and vasculopathy.



Noonan syndrome (NS)

1:1,000 to 1:2,500 (Allanson JE, 2012)

NS causes short stature, congenital heart defect, and developmental delay of variable degree. Other effects can include broad or webbed neck, unusual chest shape with superior pectus carinatum and inferior pectus excavatum, cryptorchidism, characteristic facies, varied coagulation defects, lymphatic dysplasias, and eye abnormalities. Although birth length is usually typical, final adult height approaches the lower limit of normal. Congenital heart disease occurs in 50%-80% of individuals. Pulmonary valve stenosis, often with dysplasia, is the most common heart defect and is found in 20%-50% of individuals. Hypertrophic cardiomyopathy (HCM), found in 20%-30% of individuals, may be present at birth or develop in infancy or childhood. Other structural heart defects include atrial and ventricular septal defects, branch pulmonary artery stenosis, and tetralogy of Fallot. Up to one third of affected individuals have mild intellectual disabilities.

Noonan syndrome with loose anagen hair (NSLAH)

NSLAH, also called Mazzanti syndrome, features include short stature, facial features typical of NS including macrocephaly, high forehead, hypertelorism, palpebral ptosis, and low set and posteriorly rotated ears, short and webbed neck, redundant skin, hypernasal voices and pectus abnormalities. Also enlarged cerebrospinal fluid spaces, severe growth hormone deficiency, mild psychomotor delay with ADHD that improves with age, mild dilation of the pulmonary root, and a unique combination of ectodermal abnormalities (darkly pigmented skin with eczema or ichthyosis). Generally the skin is darkly pigmented and hairless. The hair of the head has the characteristics of loose anagen hair syndrome, which is easily pluckable, sparse, thin, slow-growing and generally silver-blond. Common cardiac anomalies include mitral valve and septal defects. Mazzanti et al. (2003) suggested the disorder in these children is distinct from Noonan syndrome.

Noonan syndrome with multiple lentigines (NSML) formerly known as LEOPARD syndrome (LS)

NSML was formerly known as LEOPARD syndrome (LS), an acronym for the key features **l**entigines, **E**CG conduction abnormalities, **o**cular hypertelorism (widely set eyes), **p**ulmonic stenosis, **a**bnormal genitalia, **r**etardation of growth, and sensorineural **d**eafness; however, all these traits may not develop in an affected person. Multiple lentigines look like dispersed flat, black-brown spots, mostly on the face, neck and upper part of the trunk. In general, these spots do not appear until the person is four to five years old, but then increase to the thousands by puberty. Some individuals with NSML/LS do not develop lentigines. About 85% of people with NSML/LS have heart defects, including hypertrophic cardiomyopathy (HCM) (typically appearing during infancy and is sometimes progressive) and pulmonary valve stenosis. In fewer than half of individuals with NSML/LS, growth after birth is slow, which results in short stature. Sensorineural deafness, present in about 20%, is poorly defined. Intellectual disability, typically mild, affects about 30% of individuals with NSML/LS.

Photos courtesy of Rick Guidotti/Positive Exposure, Anahita Avalos, families and individuals – with much appreciation and gratitude.