Autism spectrum disorder

Description

Autism spectrum disorder (ASD) is a condition that appears very early in childhood development, varies in severity, and is characterized by impaired social skills, communication problems, and repetitive actions. These difficulties can interfere with affected individuals' ability to function in social, academic, and employment settings. People with ASD also have an increased risk of psychiatric problems such as anxiety, depression, obsessive-compulsive disorder, and eating disorders.

From as early as 1 to 2 years of age, people with ASD have an impaired ability to interact with other people; they are often more comfortable dealing with objects. Affected individuals have difficulty understanding and using non-verbal social cues such as eye contact, facial expressions, gestures, and body language. Inability to recognize and use these cues makes it hard for affected individuals to understand the feelings of others or communicate their own feelings appropriately. Signs of ASD, such as reduced eye contact and social interaction, can sometimes be detected before age 2. However, the condition is usually diagnosed between ages 2 and 4, when more advanced communication and social skills, such as learning to play with others, typically begin to develop.

Repetitive actions in ASD can include simple actions such as rocking, hand-flapping, or repetition of words or noises (echolalia). Affected individuals often dwell on or repeatedly express particular thoughts; this trait is called perseveration. People with ASD tend to be rigid about their established routines and may strongly resist disruptions such as changes in schedule. They may also have difficulty tolerating sensory stimuli such as loud noises or bright lights.

While social and communication difficulties and unusual actions define ASD, affected individuals can have a wide range of intellectual abilities and language skills. A majority of people with ASD have mild to moderate intellectual disability, while others have average to above-average intelligence. Some have particular cognitive abilities that greatly surpass their overall level of functioning, often in areas such as music, mathematics, or memory.

Some people with ASD do not speak at all, while others use language fluently. However, fluent speakers with ASD often have problems associated with verbal communication. They might speak in a monotone voice, have unusual vocal mannerisms, or choose unusual topics of conversation.

Several diagnoses that used to be classified as separate conditions are now grouped together under the diagnosis of ASD. For example, autistic disorder was a term that was used when affected individuals had limited or absent verbal communication, often in combination with intellectual disability. By contrast, Asperger syndrome was a diagnosis formerly applied to affected individuals of average or above-average intelligence who were not delayed in their language development. The broader diagnosis of ASD was established because many affected individuals fall outside of the strict definitions of the narrower diagnoses, and their intellectual and communication abilities may change over time. However, some individuals who were previously diagnosed with one of the subtypes now do not meet all the criteria of the new umbrella diagnosis.

Frequency

ASD is a common condition, and the number of children diagnosed with ASD has been increasing rapidly in the past few decades. In 2021, the prevalence of the disorder in the United States is estimated at 1 in 44 children. In the 1980s, before the term ASD was used, the prevalence of autism was reported to be about 1 in 2,000. However, it is unclear whether this represents a true increase in the prevalence of ASD or reflects changes in the way characteristics of the disorder have been diagnosed and categorized.

ASD is more than four times as common in boys than it is in girls.

Causes

Changes in over 1,000 genes have been reported to be associated with ASD, but a large number of these associations have not been confirmed. Many common gene variations are thought to affect the risk of developing ASD, but not all people with one or more of these gene variations will be affected. Individually, most of the gene variations have only a small effect. Genetic factors are estimated to contribute 40 to 80 percent of ASD risk.

The risk from gene variants combined with environmental risk factors, such as parental age, birth complications, and others that have not been identified, determine an individual's risk of developing this complex condition.

By contrast, in about 2 to 4 percent of people with ASD, rare gene mutations or chromosome abnormalities are thought to be the cause of the condition, often as a feature of syndromes that also involve additional signs and symptoms affecting various parts of the body. For example, mutations in the *ADNP* gene cause a disorder called ADNP syndrome. In addition to ASD and intellectual disability, this condition involves distinctive facial features and a wide variety of other signs and symptoms. Some of the other genes in which rare mutations are associated with ASD, often with other signs and symptoms, are *ARID1B*, *ASH1L*, *CHD2*, *CHD8*, *DYRK1A*, *POGZ*, *SHANK3*, and *SYNGAP1*. In most individuals with ASD caused by rare gene mutations, the mutations occur in only a single gene.

Many of the genes associated with ASD are involved in the development of the brain.

The proteins produced from these genes affect multiple aspects of brain development, including production, growth, and organization of nerve cells (neurons). Some affect the number of neurons that are produced, while others are involved in the development or function of the connections between neurons (synapses) where cell-to-cell communication takes place, or of the cell projections (dendrites) that carry signals received at the synapses to the neuron. Many other genes associated with ASD affect development by controlling (regulating) the activity of other genes or proteins.

The specific ways that changes in these and other genes relate to the development of ASD are unknown. However, studies indicate that during brain development, some people with ASD have more neurons than normal and overgrowth in parts of the outer surface of the brain (the cortex). In addition, there are often patchy areas where the normal structure of the cortex is disturbed. Normally the cortex has six layers, which are established during development before birth, and each layer has specialized neurons and different patterns of neural connection. The neuron and brain abnormalities occur in the frontal and temporal lobes of the cortex, which are involved in emotions, social behavior, and language. These abnormalities are thought to underlie the differences in socialization, communication, and cognitive functioning characteristic of ASD.

Learn more about the genes associated with Autism spectrum disorder

- ADNP
- ANK2
- ARID1B
- ASH1L
- CHD2
- CHD8
- CTNND2
- DYRK1A
- GRIN2B
- KCNQ3
- MECP2
- POGZ
- PTEN
- RELN
- SHANK3
- SYNGAP1
- UBE3A

Additional Information from NCBI Gene:

- ASXL3

- CACNA1H
- CNTN4
- CNTNAP2
- DSCAM
- EIF4E
- GABRB3
- KATNAL2
- KCNQ5
- KDM5A
- KDM5B
- MYT1L
- NLGN1
- NLGN3
- NRXN1
- PTCHD1
- RPL10
- SCN2A
- SHANK2
- SYN1
- SYN2
- TBR1
- TMLHE

Inheritance

ASD has a tendency to run in families, but the inheritance pattern is usually unknown. People with gene changes associated with ASD generally inherit an increased risk of developing the condition, rather than the condition itself. When ASD is a feature of another genetic syndrome, it can be passed on according to the inheritance pattern of that syndrome.

Other Names for This Condition

- ASD
- Autistic continuum
- Pervasive developmental disorder

Additional Information & Resources

Genetic Testing Information

- Genetic Testing Registry: Autism spectrum disorder (https://www.ncbi.nlm.nih.gov/gtr/conditions/C1510586/)

Genetic and Rare Diseases Information Center

- Rare disease with autism (https://rarediseases.info.nih.gov/diseases/10248/index)

Patient Support and Advocacy Resources

- National Organization for Rare Disorders (NORD) (https://rarediseases.org/)

Clinical Trials

- ClinicalTrials.gov (https://clinicaltrials.gov/search?cond=%22Autism spectrum disorder%22)

Catalog of Genes and Diseases from OMIM

- AUTISM (https://omim.org/entry/209850)

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28Autism+Spectrum+Disorder%5BMAJR%5D%29+AND+%28autism+spectrum+disorder%5BTI%5D%29+AND+review%5Bpt%5D+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22%5Bdp%5D)

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