



Autism Spectrum Disorder (ASD)

ASD is a complex developmental disorder that affects how a person behaves, interacts with others, communicates, and learns. NICHD is one of many federal agencies and NIH Institutes working to understand ASD. NICHD supports and conducts research on what causes autism, how best to detect signs of autism, how best to treat autism and its symptoms, and other topics.

About Autism

Autism spectrum disorder (ASD) is a complex neurological and developmental disorder that begins early in life and affects how a person acts and interacts with others, communicates, and learns. ASD affects the structure and function of the brain and nervous system. Because it affects development, ASD is called a **developmental disorder**. ASD can last throughout a person's life.

People with this disorder have problems with:¹

- Communication and interaction with other people
- Restricted interests and repetitive behaviors

Different people with autism can have different symptoms. For this reason, autism is known as a **spectrum disorder**—which means that there is a range of similar features in different people with the disorder.¹ This website uses "ASD" and "autism" to mean the same thing.

In giving a diagnosis of ASD, a health care provider will also specify whether the person also has:¹

- Intellectual problems, including problems with reasoning or memory
- Language problems, such as problems with speech
- Another medical or genetic condition that is related to or contributes to autism, such as seizures or Fragile X syndrome (</health/topics/fragilex/Pages/default.aspx>)

In May 2013, a revised version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), the guidelines health care providers use to diagnose different mental health conditions, was released. The DSM-5 made significant changes to how autism is classified and diagnosed.

Now: Under the DSM-5, someone with more severe autism symptoms and someone with less severe autism symptoms both have the same disorder: ASD.

Then: In the previous version of the DSM, ASD was a category and there were four types of autism within the category. These were **autistic disorder** ("classic" autism), **Asperger syndrome** (which usually involved milder symptoms, mostly related to social behaviors), **childhood disintegrative disorder** (in which development would seem typical for several months or years, then would lose skills related to language, movement and coordination, and other brain functions), and **pervasive developmental disorder not otherwise specified** (PDD-NOS, or "atypical" autism, which included some, but not all, of the features of classic autism or Asperger syndrome).²

Health care providers no longer use these terms to describe someone with ASD.

The Centers for Disease Control and Prevention tracks the number of people who have ASD. Learn more at <https://www.cdc.gov/ncbddd/autism/data.html> (<https://www.cdc.gov/ncbddd/autism/data.html>).

Citations



1. *Diagnostic and Statistical Manual of Mental Disorders*, 5th Edition. (2013). American Psychiatric Association: Washington, DC.
2. *Diagnostic and Statistical Manual of Mental Disorders*, 4th Edition Text Revision. (2000). American Psychiatric Association: Washington, DC.

What are the symptoms of autism?

The symptoms of one person with autism can be very different from the symptoms of another person with autism. Health care providers think of autism as a **spectrum disorder**—which means that there is a range of similar features in different people with the disorder.¹

One person with autism may have mild symptoms, while another may have more serious symptoms, but they both have autism spectrum disorder (ASD).

Despite the range of possible symptoms, there are certain actions and behaviors that are common in ASD and could signal that a child is on the autism spectrum. Parents and caregivers who notice these "**red flags**" should speak to their child's health care provider about autism and screening the child for ASD.

In general, the main signs and symptoms of ASD relate to:

- Communication and interactions with other people
- Routines or repetitive behaviors, sometimes called stereotyped (pronounced *STER-ee-uh-tahypt*) behaviors

Health care providers organize some noticeable symptoms of autism into "red flags" to help parents and caregivers know what to look for as children grow and develop. These red flags are listed below.

Red Flags for ASD^{2,3}

Communication



- Does not respond to his/her name by 12 months of age
- Cannot explain what he/she wants
- Doesn't follow directions
- Seems to hear sometimes, but not other times
- Doesn't point or wave "bye-bye"
- Used to say a few words or babble, but now does not

Social Behavior



- Doesn't smile when smiled at
- Has poor eye contact

- Seems to prefer to play alone
- Gets things for him/herself only
- Is very independent for his/her age
- Seems to be in his/her "own world"
- Seems to tune people out
- Is not interested in other children
- Doesn't point out interesting objects by 14 months of age
- Doesn't like to play "peek-a-boo"
- Doesn't try to attract his/her parent's attention

Stereotyped Behavior

- Gets "stuck" doing the same things over and over and can't move on to other things
- Shows unusual attachments to toys, objects, or routines (for example, always holding a string or having to put on socks before pants)
- Spends a lot of time lining things up or putting things in a certain order
- Repeats words or phrases (sometimes called echolalia [pronounced *ek-oh-LEE-lee-uh*])

Other Behavior

- Doesn't play "make believe" or pretend by 18 months of age
- Has odd movement patterns
- Doesn't know how to play with toys
- Does things "early" compared to other children
- Walks on his/her toes
- Doesn't like to climb on things such as stairs
- Doesn't imitate silly faces
- Seems to stare at nothing or wander around with no purpose
- Throws intense or violent tantrums
- Is overly active, uncooperative, or resistant
- Seems overly sensitive to noise
- Doesn't like to be swung or bounced on his/her parent's knee, etc.

You can find age-specific milestones on the Centers for Disease Control and Prevention website [Learn the Signs. Act Early.](https://www.cdc.gov/ncbddd/actearly/milestones/index.html) (<https://www.cdc.gov/ncbddd/actearly/milestones/index.html>). If your child does

not meet developmental milestones, talk to his or her health care provider about screening for ASD.

Note about these red flags:

- Some of these red flags apply only at certain ages, so consider what is typical for other children your child's age.
- Some red flags are more strongly associated with autism than others.
- If your child shows any red flags for autism, talk to his or her health care provider.

Citations



1. *Diagnostic and Statistical Manual of Mental Disorders*, 5th Edition. (2013). American Psychiatric Association: Washington, DC.
2. Johnson CP, & Myers SM; American Academy of Pediatrics Council on Children with Disabilities. (2007). Identification and evaluation of children with autism spectrum disorders. *Pediatrics*, 120(5), 1183-1215.
3. CDC. Autism Spectrum Disorders—Signs & Symptoms. (2015). Retrieved January 10, 2017, from <http://www.cdc.gov/ncbddd/autism/signs.html>.

When do children usually show symptoms of autism?

The behavioral symptoms of autism spectrum disorder (ASD) often appear early in development.¹ Many children show symptoms of autism by 12 months to 18 months of age or earlier.^{2,3} Some early signs of autism include:^{4,5,6}

- Problems with eye contact
- No response to his or her name
- Problems following another person's gaze or pointed finger to an object (or "joint attention")
- Poor skills in pretend play and imitation
- Problems with nonverbal communication

Many parents are not aware of these "early" signs of autism and don't start thinking about autism until their children do not start talking at a typical age.

Most children with autism are not diagnosed until after age 3, even though health care providers can often see developmental problems before that age.^{7,8,9,21}

Research shows that early detection and early intervention (</health/topics/autism/conditioninfo/treatments/Pages/early-intervention.aspx>) greatly improve outcomes,¹⁰ so it's important to look for these symptoms when a child is as young as possible.¹¹

Regression



Some children with autism **regress**, meaning they stop using language, play, or social skills that they've already learned. This regression may happen between ages 1 year and 2 years. It might happen earlier for some social behaviors, such as looking at faces and sharing a smile. Researchers don't know why some children regress into autism or which children are likely to regress.^{12,13,14,15,16}

At what age do children show signs of autism?



Other Early Signs



There also may be early biological signs of ASD. Recent studies have shown that:

- People with autism have unique brain activity, structures, and connections even at very young ages.^{17,18}
- There are differences in brain growth in ASD as early as 6 months of age.^{19,20,22,23}

Citations



1. *Diagnostic and Statistical Manual of Mental Disorders*, 5th Edition. (2013). American Psychiatric Association: Washington, DC.
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What causes autism?

Scientists don't know exactly what causes autism spectrum disorder (ASD).

Autism was first described in the 1940s, but very little was known about it until the last few decades. Even today, there is a great deal that we don't know about autism.

Because the disorder is so complex and no two people with autism are exactly alike, there are probably many causes for autism. It is also likely that there is not a single cause for autism, but rather that it results from a combination of causes.

Scientists are studying some of the following as possible causes of or contributors to ASD.

Genes and ASD



A great deal of evidence supports the idea that genes are one of the main causes of or a major contributor to ASD. More than 100 genes on different chromosomes may be involved in causing ASD, to different degrees.^{3,4}

Many people with autism have slight changes, called **mutations**, in many of these genes. However, the link between genetic mutations and autism is complex:

Genes: Bits of DNA that carry instructions for "building" your body.

Chromosomes: Packages of DNA and genes in the cells of the body.

- Most people with autism have different mutations and combinations of mutations. Not everyone with autism has changes in every gene that scientists have linked to ASD.
- Many people without autism or autism symptoms also have some of these genetic mutations that scientists have linked to autism.

This evidence means that different genetic mutations probably play different roles in ASD. For example, certain mutations or combinations of mutations might:

- Cause specific symptoms of ASD
- Control how mild or severe those symptoms are

- Increase susceptibility to autism. This means someone with one of these gene mutations is at greater risk for autism than someone without the mutation.

Interactions between Genes and the Environment

If someone is susceptible to ASD because of genetic mutations, then certain situations might cause autism in that person.

For instance, an infection or contact with chemicals in the environment could cause autism in someone who is susceptible because of genetic mutations.¹ However, someone who is genetically susceptible might not get an ASD even if he or she has the same experiences.²

Other Biological Causes

Researchers are also looking into biological factors other than genes that might be involved in ASD. Some of these include:

- Problems with brain connections
- Problems with growth or overgrowth in certain areas of the brain
- Problems with metabolism (the body's energy production system)
- Problems in the body's immune system, which protects against infections

Citations



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How do health care providers diagnose autism?

Health care providers look for certain symptoms or groups of symptoms to diagnose autism spectrum disorder (ASD). If you have concerns about your child's development, talk to his or her health care provider right away. The provider then can examine the child and check for specific problems, such as autism.

Routine Developmental Screening



Your child's health care provider will check for problems with your child's development at every well-baby and well-child visit, even if you don't report any of the signs of autism or other problems.^{1,2} In addition, the American Academy of Pediatrics recommends that health care providers administer an ASD-specific tool to assess development at the 18-month and 24-month visits regardless of whether the child has risk factors for ASD.³

During these developmental screenings, the health care provider may:

- Ask you specific questions about your child's actions and behavior
- Ask you to fill out a questionnaire about your child's behavior
- Speak directly to the child

Specialized Screening for ASD



The health care provider might use a screening test specifically for ASD. This test might be the Checklist of Autism in Toddlers (CHAT), the Modified Checklist for Autism in Toddlers (M-CHAT), or another test.¹

In addition, the health care provider may also recommend that your child have a blood test to help rule out some other conditions and problems.²

Depending on the results of the blood test and the developmental and other screenings, your child's health care provider will either:

- Rule out autism or
- Refer your child to a specialist in child development or another specialized field to diagnose the child with autism. The specialist will then do a number of tests to figure out whether your child has autism or another condition. These will include tests of your child's communication abilities and observation of the child's behaviors.

Because the diagnostic criteria for ASD changed in 2013 (see below), ongoing research will help ensure that these screening tests are accurately identifying children who meet the new criteria for ASD.

Diagnosing ASD

The American Psychiatric Association, a professional society of psychiatrists, updated the criteria for an autism diagnosis in May 2013. The criteria are published in the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (DSM-5).

According to the DSM-5 criteria, a person has ASD if he or she:⁴

- Has problems with communication and social interactions, namely:
 - Doesn't respond appropriately to social and emotional cues
 - Has deficits in nonverbal communication during social interactions
 - Has trouble developing friendships, keeping friends, and understanding relationships
- Has at least two types of repetitive behavioral patterns. These might include repetitive movements, inflexible routines, very restricted interests, or unusual responses to certain sensory inputs, such as the way a particular object feels.

There are various tools that specialists commonly use to diagnose autism. The only tool that currently fits the revised DSM-5 criteria is the Autism Diagnostic Observation Schedule (ADOS-2). However, it alone is not enough to make a diagnosis of ASD. Existing diagnostic tools are being modified to better fit the DSM-5 criteria.

During an ADOS-2 assessment, the specialist interacts directly with your child in social and play activities. For example, the specialist will see whether your child responds to his or her name and how he or she performs in pretend play, such as with dolls. The specialist is looking for specific characteristics that are hallmarks of ASD. To be diagnosed with ASD, a child must have had symptoms since an early age.⁴

As part of the diagnosis, the specialist will also note whether your child has:⁴

- Any genetic disorder that is known to cause ASD or its symptoms, including Fragile X syndrome

(</health/topics/fragilex/Pages/default.aspx>) or [Rett syndrome \(/health/topics/rett/Pages/default.aspx\)](/health/topics/rett/Pages/default.aspx); your child might receive a genetic test to detect these types of disorders.

- A language disability and the level of disability
- Intellectual disability and the level of disability
- Any medical conditions common among those with ASD, such as seizures, anxiety, depression, or problems with the digestive system

Depending on your child's unique symptoms and needs, the team of specialists may also want to give your child a range of other tests. If your child shows symptoms of seizures, a brain specialist, or neurologist, might use electrical sensors to observe your child's brain activity.

Your child may need other tests to determine how best to treat the symptoms of ASD. A hearing specialist, or audiologist, might test your child's hearing, which can sometimes seem poor in children with ASD. Other tests might include tests of muscle strength and tests of your child's ability to control movement.

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What are the treatments for autism?

There is currently no one standard treatment for autism spectrum disorder (ASD).

But there are many ways to help minimize the symptoms and maximize abilities. People who have ASD have the best chance of using all of their abilities and skills if they receive appropriate therapies and interventions.

Many people with ASD benefit from treatment, no matter how old they are when they are diagnosed. People of all ages, at all levels of ability, can often improve after well-designed interventions.

The most effective therapies and interventions are often different for each person. However, most people with ASD respond best to highly structured and specialized programs.¹ In some cases, treatment can greatly reduce symptoms and help people with autism with daily activities.

Research shows that early diagnosis and interventions, such as during preschool or before, are more likely to have major positive effects on symptoms and later skills. Read more about [early interventions](/health/topics/autism/conditioninfo/treatments/Pages/early-intervention.aspx) for autism.


Because there can be overlap in symptoms between ASD and other disorders, such as attention deficit hyperactivity disorder (ADHD),² it's important that treatment focus on a person's specific needs, rather than the diagnostic label.

Select the links for more information on each type of treatment for ASD.

- [Behavioral management therapy](/health/topics/autism/conditioninfo/treatments/Pages/behavioral-management.aspx)
- [Cognitive behavior therapy](/health/topics/autism/conditioninfo/treatments/Pages/cognitive-behavior.aspx)
- [Early intervention](/health/topics/autism/conditioninfo/treatments/Pages/early-intervention.aspx)
- [Educational and school-based therapies](/health/topics/autism/conditioninfo/treatments/Pages/educational-therapies.aspx)
- [Joint attention therapy](/health/topics/autism/conditioninfo/treatments/Pages/joint-attention.aspx)

- Medication treatment
(</health/topics/autism/conditioninfo/treatments/Pages/medication-treatment.aspx>)
- Nutritional therapy
(</health/topics/autism/conditioninfo/treatments/Pages/nutritional-therapy.aspx>)
- Occupational therapy
(</health/topics/autism/conditioninfo/treatments/Pages/occupational-therapy.aspx>)
- Parent-mediated therapy
(</health/topics/autism/conditioninfo/treatments/Pages/parent-mediated.aspx>)
- Physical therapy
(</health/topics/autism/conditioninfo/treatments/Pages/physical-therapy.aspx>)
- Social skills training
(</health/topics/autism/conditioninfo/treatments/Pages/social-skills.aspx>)
- Speech-language therapy
(</health/topics/autism/conditioninfo/treatments/Pages/speech-language.aspx>)

If you have a question about treatment, talk to a health care provider who specializes in caring for people with ASD. These resources have more information about treatments for autism:

- The Centers for Disease Control and Prevention describes some treatment options. <http://www.cdc.gov/ncbddd/autism/treatment.html> (<http://www.cdc.gov/ncbddd/autism/treatment.html>)
- The Autism Speaks organization offers a Family Services Resources guide. You can search the guide to find autism-related care and services in your area. <http://www.autismspeaks.org/community/fsdb/search.php> (<http://www.autismspeaks.org/community/fsdb/search.php>)  ([external-disclaimer](#))

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Behavioral Management Therapy for Autism

Behavior management therapy tries to reinforce wanted behaviors and reduce unwanted behaviors. It also suggests what caregivers can do before, during, after, and between episodes of problem behaviors.

Behavioral therapy is often based on **applied behavior analysis (ABA)**, a widely accepted approach that tracks a child's progress in improving his or her skills.

Different types of ABA commonly used to treat autism spectrum disorder (ASD) include:

- **Positive Behavioral and Support (PBS)**. PBS aims to figure out why a child does a particular problem behavior. It works to change the environment, teach skills, and make other changes that make a correct behavior more positive for the child. This encourages the child to behave more appropriately.
- **Pivotal Response Training (PRT)**. PRT takes place in the child's everyday environment. Its goal is to improve a few "pivotal" skills, such as motivation and taking initiative to communicate. These help the child to learn many other skills and deal with many situations.
- **Early Intensive Behavioral Intervention (EIBI)**. EIBI provides individualized, behavioral instruction to very young children with ASD. It requires a large time commitment and provides one-on-one or small-group instruction.
- **Discrete Trial Teaching (DTT)**. DTT teaches skills in a controlled, step-by-step way. The teacher uses positive feedback to encourage the child to use new skills.

Keep in mind that other behavioral therapies, beyond ABA, may also be effective for people with ASD. Talk to your health care provider about the best options for your child.

Cognitive Behavior Therapy for Autism

Cognitive behavior therapy focuses on the connection between thoughts, feelings, and behaviors.

Together, the therapist, the person with autism spectrum disorder (ASD), and/or the parents come up with specific goals for the course of therapy. Throughout the sessions, the person with autism learns to identify and change thoughts that lead to problem feelings or behaviors in particular situations.^{1,2}

Cognitive behavior therapy is structured into specific phases of treatment. However, it is also individualized to patients' strengths and weaknesses. Research shows that this therapy helps people with some types of ASD deal with anxiety. It can also help some people with autism cope with social situations and better recognize emotions.

Citations



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NICHD Autism Research Goals

NICHD supports and conducts research on a wide range of topics related to autism spectrum disorder (ASD), including genetics, neurodevelopment, screening, and interventions. The overarching aims of this research are to find causes, examine developmental trajectories of the disorder, and develop new or improved interventions or preventions.

Specific objectives include:

- **Improving strategies for early screening and diagnosis.** Early screening and accurate diagnosis are prerequisites for early intervention, which is the best way to maximize the child's cognitive, social, and language functioning. Tools for screening and diagnosis may include behavioral instruments, biomarkers, imaging methodologies, and others.
- **Identifying and characterizing autism susceptibility genes.** It is still unclear how the large number of genetic variants associated with ASD increase risk for this condition.
- **Understanding the neuropathology of autism and autism-related behaviors.**
- **Understanding the role of endocrine, metabolic, and immunologic pathways in ASD.**
- **Detailing the environmental variables that interact with genetic susceptibility factors to produce the ASD phenotype.**
- **Understanding cognitive, linguistic, and emotional development in autism.**
- **Testing potential interventions for ASD.** These may include drug treatments, dietary interventions, behavioral interventions, and interventions to improve adaptability to various academic, social, and employment environments.
- **Developing preventive strategies for ASD.**
- **Contributing to the overall health and well-being of people with autism throughout the lifespan.**
- **Developing and supporting research infrastructure to aid in ASD research.** This includes autism research networks, training for researchers interested in studying autism, and banks for brain and other tissue.
- **Understanding the prevention, etiology, and treatment of conditions and diseases that are commonly comorbid with ASD, such as [Fragile X syndrome](/health/topics/fragilex/Pages/default.aspx) (</health/topics/fragilex/Pages/default.aspx>), anxiety, and epilepsy.**

In addition to these goals, NICHD also pursues goals set out by the Interagency Autism Coordinating Committee (IACC) and the NIH Autism Coordinating Committee (NIHACC). Visit <https://iacc.hhs.gov/> (<https://iacc.hhs.gov/>) to review progress reports, as well as the [2013 Update to the IACC Strategic Plan](#)

(<https://iacc.hhs.gov/publications/strategic-plan/2013/>).

Autism Research Activities and Advances

NICHD's autism spectrum disorder (ASD) research portfolio is spread throughout the Institute and includes extramural components that support research on ASD and other intellectual and developmental disabilities (IDDs) (</health/topics/idds/Pages/default.aspx>). NICHD also conducts some autism-related research projects through its intramural program.

In addition, several extramural and intramural entities within NICHD sponsor or conduct research that is not autism-focused but that can inform our understanding of the developmental and molecular processes involved in autism pathophysiology. Some of these efforts are described below.

Institute Activities and Advances



Recent Findings

- A longitudinal study of parent-reported sensory responsiveness in toddlers at-risk for autism (PMID: [30350375](https://pubmed.ncbi.nlm.nih.gov/30350375/)) (<https://www.ncbi.nlm.nih.gov/pubmed/30350375>)
- Potential for digital behavioral measurement tools to transform the detection and diagnosis of autism spectrum disorder (PMID: [30715131](https://pubmed.ncbi.nlm.nih.gov/30715131/)) (<https://www.ncbi.nlm.nih.gov/pubmed/?term=30715131>)
- Restricted and repetitive behavior and brain functional connectivity in infants at risk for developing autism spectrum disorder (PMID: [30446435](https://pubmed.ncbi.nlm.nih.gov/30446435/)) (<https://www.ncbi.nlm.nih.gov/pubmed/30446435>)
- Language delay aggregates in toddler siblings of children with autism spectrum disorder (PMID: [30348077](https://pubmed.ncbi.nlm.nih.gov/30348077/)) (<https://www.ncbi.nlm.nih.gov/pubmed/30348077>)
- Automatic emotion and attention analysis of young children at home: a ResearchKit autism feasibility study (<https://www.nature.com/articles/s41746-018-0024-6>)
- Parent support of preschool peer relationships in younger siblings of children with autism spectrum disorder (PMID: [28634707](https://pubmed.ncbi.nlm.nih.gov/28634707/)) (<https://www.ncbi.nlm.nih.gov/pubmed/28634707>)
- Walking, gross motor development, and brain functional connectivity in infants and toddlers (PMID: [29186388](https://pubmed.ncbi.nlm.nih.gov/29186388/)) (<https://www.ncbi.nlm.nih.gov/pubmed/29186388>)

As one of the participants in the government-wide Interagency Autism Coordinating Committee (IACC) (<https://iacc.hhs.gov/>), NICHD's support for autism research is structured around the seven question areas of IACC's strategic plan for autism research (<https://iacc.hhs.gov/publications/strategic-plan/2013/>):

- Question 1: When Should I Be Concerned?
- Question 2: How Can I Understand What Is Happening?
- Question 3: What Caused This to Happen and Can It Be Prevented?
- Question 4: Which Treatments and Interventions Will Help?
- Question 5: Where Can I Turn for Services?
- Question 6: What Does the Future Hold, Particularly for Adults?
- Question 7: What Other Infrastructure and Surveillance Needs Must Be Met?

NICHD supports and conducts research in all seven areas, with particular support for research relevant to questions 1 and 2.

Much of NICHD's autism research is conducted through the trans-NIH Autism Centers of Excellence (ACE) Program (</research/supported/Pages/ace.aspx>). The ACE project, established in 2007, was a consolidation of two previous research efforts—the NICHD-led Collaborative Programs of Excellence in Autism and the Studies to Advance Autism Research and Treatment (/research/supported/Pages/cpea_start.aspx). ACE was intended to better coordinate autism research across the NIH.

IACC Question 1: Diagnosis of ASD

NICHD-supported research related to IACC Question 1 aims to develop and improve screening and diagnostic tools for ASD. The Intellectual and Developmental Disabilities Branch (IDDB) (</about/org/der/branches/iddb/Pages/overview.aspx>) supports extramural research exploring ways to validate and improve screening and diagnosis tools for ASD, such as the Modified Checklist for Autism in Toddlers (M-CHAT), an effective screening tool for children aged 16 months to 2½ years. The Branch also supports the development of new screening tools, especially those for children younger than age 24 months, and the development of instruments for assessing symptoms and daily function of people with ASD.

The IDDB also supports studies that may inform the development of new screening tools in the future. IDDB-funded research tracks the anatomical, functional, emotional, communicative, and behavioral characteristics of infants at high risk for ASD over time in order to develop and improve the long-term accuracy of diagnostic and prognostic tools for ASD. The Branch also supports systematic efforts to identify genetic variants associated with autism, with the eventual goal of developing a new early diagnosis and classification system. IDDB-supported research studies also address the development of the linguistic and sensory symptoms of ASD throughout childhood, which may also inform screening tools.

- **IDDB-supported findings:** Researchers worked with health care providers to screen more than 15,000 low-risk toddlers using an updated version of MCHAT, the Modified Checklist for Autism in Toddlers—Revised, with Follow-Up (M-CHAT–R/F) and found it to be more accurate than earlier versions at identifying children who could benefit from further evaluation (</news/releases/Pages/122313-autism-screening-tool.aspx>). (PMID: 24366990 (<http://www.ncbi.nlm.nih.gov/pubmed/24366990>))

The IDDB's research support is complemented by support from the Child Development and Behavior Branch (CDBB) (</about/org/der/branches/cdbb>), for research on the processes of normal development. Data on the development of joint attention, social orientation, and emotional function and communications provide important benchmarks for understanding how early deficits in these skills develop in ASD.

NICHD's intramural scientists also conduct research relevant to this IACC question. Through its Epidemiology Branch (</about/org/diphr/officebranch/eb>), within the Division of Intramural Population Health Research (DIPHR) (</about/org/diphr/Pages/default.aspx>), the Institute is active in the assessment of the M-CHAT for ASD and other developmental screening algorithms. The DIPHR has also conducted research on the patterns of growth, physical development, and hormone levels throughout childhood in autism.

IACC Question 2: Biology of ASD

Several extramural branches of NICHD support research on disorders of neurologic and behavioral development, such as autism, by characterizing the developmental processes, cognitive processes, sensory and motor systems, and molecular and neural mechanisms that are relevant in the biology of the condition and its symptoms.

For instance, the IDDB supports research on the biology of ASD, including studies of the developmental processes underlying ASD biology throughout childhood. This research aims to characterize the cognitive and sensory/motor deficits in ASD, such as difficulties in recognizing emotion in faces and speech and the dysfunction in perceiving time or the differences between sounds. The Branch also supports research on the molecular and neurological underpinnings of ASD in humans as well as in model organisms. Funded research also delineates the function of genes and risk for ASD in brain development and function and maps the altered biochemical pathways and neural networks in brains of people with ASD to determine how these biological characteristics are correlated with behaviors or symptoms.

The IDDB is also interested in research on the biological processes that ASD has in common between ASD with comorbid or causative genetic conditions, such as [Fragile X syndrome \(/health/topics/fragilex/Pages/default.aspx\)](/health/topics/fragilex/Pages/default.aspx), [t syndrome \(/health/topics/rett/Pages/default.aspx\)](/health/topics/rett/Pages/default.aspx), Angelman syndrome, and [Prader-Willi syndrome \(/health/topics/prader-willi/Pages/default.aspx\)](/health/topics/prader-willi/Pages/default.aspx). The Branch also funds research to find or characterize subtypes of autism, by identifying new genes related to ASD risk and correlating known risk genes with brain structure and function and symptoms.

In addition, the CDBB's [Developmental Cognitive Psychology, Behavioral Neuroscience, and Psychobiology Program \(/about/org/der/branches/cdbb\)](/about/org/der/branches/cdbb) funds studies to identify and characterize the pathways involved in brain development and behavior, including those in the sensory, motor, linguistic, cognitive, and social behavioral domains, all of which are disrupted in ASD. The Branch's studies of typically developing children serve as an important benchmark for understanding the differences found in children with ASD.

The [Developmental Biology and Structural Variation Branch \(/about/org/der/branches/dbsvb/Pages/overview.aspx\)](/about/org/der/branches/dbsvb/Pages/overview.aspx) also supports research on normal and abnormal development relating to the causes and prevention of congenital and genetic defects, as well as research training in relevant academic and medical areas, with an emphasis on the biochemical, genetic, and cellular mechanisms of early development that can be disrupted in disorders like ASD.

The [Section on Cellular and Synaptic Physiology \(https://annualreport.nichd.nih.gov/mcbain.html\)](https://annualreport.nichd.nih.gov/mcbain.html), within the [Division of Intramural Research \(DIR\) \(http://dir.nichd.nih.gov/dirweb/home.html\)](http://dir.nichd.nih.gov/dirweb/home.html) [Neurosciences Affinity Group](#)

([/about/org/dir/affinity-groups/neurosciences](#)), focuses on the development and regulation of synapses in the cortex and hippocampus. Networks in these areas are disrupted in ASD and other brain disorders.

IACC Question 3: Causes and Preventions of ASD

The IDDB is a major supporter of human and animal studies on the causes of ASD, including investigation of the processes and pathways associated with ASD, autism symptoms, common co-morbidities, and protective factors for ASD. One large area of IDDB support is genetics and epigenetics. The Branch funds studies of the identification, expression, regulation, and interactions of gene variants linked to ASD and autism-related behaviors and symptoms. The IDDB also supports research on potential environmental risk factors and biomarkers for ASD, including gene-environment interactions.

In addition, two laboratories within the DIR conduct research relevant to the biology of ASD:

- [The Section on Molecular](https://annualreport.nichd.nih.gov/porter.html) (<https://annualreport.nichd.nih.gov/porter.html>) conducts research on a potential new endophenotype of ASD related to hypocholesterolemia.
- [The Section on Clinical Genomics](https://annualreport.nichd.nih.gov/2015/rennert.html) (<https://annualreport.nichd.nih.gov/2015/rennert.html>) uses a cell-culture model to study neuronal networks in autism. Its research also examines the expression of non-coding RNA in the brain in autism.

IACC Question 4: Interventions for ASD

The IDDB supports research on the development and evaluation of therapies and treatments for ASD, ASD symptoms, and related disorders, such as [Fragile X syndrome](#) ([/health/topics/fragilex/Pages/default.aspx](#)), as well as the long-term effects of these interventions. Potential treatment targets include repetitive behavior, joint attention, social skills, emotional sharing, symbolic understanding, language and communication, irritability and anxiety, and insistence on sameness. Researchers working in human subjects and animal models consider a range of treatment types, from behavioral and educational interventions to pharmaceutical treatments, including comprehensive treatments that combine behavior and medication.

- **IDDB-supported findings:** A recent ACE network study found that directing the attention of preschool-aged children with ASD increased the children's

vocabularies and language skills by the time they were age 8, compared to a control. In the intervention, adults actively engaged the children's attention by pointing to toys and using other gestures.

IACC Question 5: Services for People with ASD

As a research agency, NICHD focuses its efforts on evaluating services—how they are delivered or how effective they are, for example—rather than on providing services. For instance, the IDDB supports a few studies of methods to develop or improve services for people with ASD, including services related to teaching life skills and ensuring physical safety of people with ASD.

IACC Question 6: Health Over the Lifespan with ASD

Most NICHD research addresses the early biological origins of ASD, meaning that efforts related to this question are handled by other agencies. However, through the IDDB, NICHD supports one study related to this question, focused on teaching social skills to adolescents with high-functioning ASD.

IACC Question 7: Infrastructure for ASD Research

Much of the Institute's work within this area is related to support of the ACE program. In 2012, NIH awarded \$100 million to continue support of the program. The Institute also supports other projects related to ASD research infrastructure, including the National Database for Autism Research, Brain and Tissue Bank, and NeuroBioBank resources that are described in the [Other Activities and Advances](#) (</health/topics/autism/researchinfo/Pages/activities.aspx#other>) section below.

Other Activities and Advances

To achieve its goals for autism research, NICHD supports a variety of other activities related to autism. Some of these activities are managed through the components listed above; others are part of NIH-wide or collaborative efforts in which NICHD participates. Some of these are listed below:

- The [Autism Centers of Excellence \(ACE\) Program](#) (</research/supported/Pages/ace.aspx>) is the trans-NIH research effort on ASD.
- The [Collaborative Programs of Excellence in Autism \(CPEAs\)/Studies to Advance Autism Research & Treatment \(STAART\) Centers](#) (/research/supported/Pages/cpea_staart.aspx) conducted and supported

studies on the causes, diagnosis, prevention, detection, and treatment of ASD. These Networks were consolidated in 2007 into the ACE Program to enable pooling of resources and maximum coordination and efficiency for autism research across the NIH.

- NICHD's Eunice Kennedy Shriver Intellectual and Developmental Disabilities Research Centers (</research/supported/Pages/eksiddrc.aspx>) are located at 15 universities and children's hospitals throughout the country and aim to advance understanding of a variety of conditions and topics related to IDD.
- The Fragile X Syndrome Research Center Program (</research/supported/Pages/ccrfx.aspx>), funded by the IDDB, supports research to improve the diagnosis and treatment of Fragile X syndrome and related conditions.
- The government-wide Interagency Autism Coordinating Committee (IACC) (<https://iacc.hhs.gov/>) includes representatives from NICHD.
- The National Database for Autism Research (<https://ndar.nih.gov/>) includes relevant data at all levels of biological and behavioral organization (i.e., molecules, genes, neural tissues, social and environmental interactions) and for all data types (e.g., text, numeric, image, time series).
- The NIH NeuroBio (<https://neurobiobank.nih.gov/>) Bank is a network of brain and tissue banks in the United States that collect, examine, and store tissues; the banks also make the tissues available to scientists for research on brain disorders.
- The NICHD Brain and Tissue Bank for Developmental Disorders (<http://medschool.umaryland.edu/BTBank/>) [\(/Pages/external-disclaimer.aspx\)](/Pages/external-disclaimer.aspx) systematically collects, stores, and distributes brain and other tissues for research dedicated to the improved understanding, care, and treatment of individuals with developmental disabilities, including ASD.

Early Intervention for Autism

Research shows that early diagnosis of and interventions for autism are more likely to have major long-term positive effects on symptoms and later skills.^{1,2,3,4,5} Autism spectrum disorder (ASD) can sometimes be diagnosed in children before they are 2 years of age. Some children with ASD whose development seems typical up to that point begin to regress just before or sometime during age 2 years.⁶

Early interventions occur at or before preschool age, as early as 2 or 3 years of age. In this period, a young child's brain is still forming,⁷ meaning it is more "plastic" or changeable than at older ages. Because of this plasticity, treatments have a better chance of being effective in the longer term.⁶ Early interventions not only give children the best start possible, but also the best chance of developing to their full potential. The sooner a child gets help, the greater the chance for learning and progress. In fact, recent guidelines suggest starting an integrated developmental and behavioral intervention as soon as ASD is diagnosed or seriously suspected.⁶

Early intervention programs often include:

- Family training
- Speech therapy
- Hearing impairment services
- Physical therapy
- Nutrition services

With early intervention, some children with autism make so much progress that they are no longer on the autism spectrum when they are older. Many of the children who later go off the spectrum have some things in common:³

- Diagnosis and treatment at younger ages
- A higher intelligence quotient (IQ, a measure of thinking ability) than average for a child with autism
- Better language and motor skills

Goals of Early Intervention



Early intervention programs help children gain the basic skills that they usually learn in the first 2 years of life, such as:

- Physical skills
- Thinking skills
- Communication skills
- Social skills
- Emotional skills



State-Run Programs



Each state has its own early intervention program for children from birth to age 2 years who are diagnosed with developmental delays or disabilities, including ASD. These programs are specified by Part C of Public Law 108-77: Individuals with Disabilities Education Improvement Act (2004)

(<https://sites.ed.gov/idea/statuteregulations/>), sometimes called "IDEA."⁸ Some states also provide services for children who are at risk for developmental delays and disabilities.

To learn more about early intervention services, visit one of the following sites:

- Autism Speaks: Early Intervention Offices by State
<https://www.autismspeaks.org/early-access-care/ei-state-info>
(<https://www.autismspeaks.org/early-access-care/ei-state-info>)  ([/external-disclaimer](#))
- Building the Legacy: IDEA 2004
<https://sites.ed.gov/idea/> (<https://sites.ed.gov/idea/>)
- Center for Parent Information and Resources
<http://www.parentcenterhub.org> (<http://www.parentcenterhub.org/>) 
([/external-disclaimer](#))

Citations



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2. Olley, J. G. (2005). Curriculum and classroom structure. In: Volkmar, F. R., Paul, R., Klin, A., Cohen, D. (Eds.), *Handbook of Autism and Pervasive Developmental Disorders*. 3rd ed. Vol II (863–881). Hoboken, NJ: John Wiley & Sons.
3. Helt, M., Kelley, E., Kinsbourne, M., Pandey, J., Boorstein, H., Herbert, M., et al. (2008). Can children with autism recover? If so, how? *Neuropsychology Review*, *18*(4), 339–366.
4. Rogers, S. J., & Lewis, H. (1989). An effective day treatment model for young children with pervasive developmental disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *28*(2), 207–214.
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7. Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., et al. (2010). Randomized, controlled trial of an intervention for toddlers with autism: the Early Start Denver Model. *Pediatrics*, *125*(1), e17–23.
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Educational and School-Based Therapies for Autism

Children with autism are guaranteed free, appropriate public education under the federal laws of Public Law 108-177: Individuals with Disabilities Education Improvement Act (2004) (<https://sites.ed.gov/idea/>), sometimes called "IDEA."

IDEA ensures that children diagnosed with certain disabilities or conditions, including autism spectrum disorder (ASD), get free educational services and educational devices to help them to learn as much as they can.

NICHHD-funded researchers have also incorporated communications interventions for children with ASD within the classroom setting, with successful outcomes. Although the specific interventions used in the study are not a guaranteed part of IDEA, components from the program could provide an important evidence-based foundation for future school-based therapies.¹

IDEA Covers Children and Young Adults



In most states, each child is entitled to these services from age 3 years through high school, or until age 21, whichever comes first. Some states now offer these types of services beyond age 21. You can find the specific rules of IDEA for each state (<https://ectacenter.org/sec619/stateregs.asp>) [↗](#) ([/Pages/external-disclaimer.aspx](#)) from the National Early Childhood Technical Assistance Center.

Educational Environment



IDEA states that children must be taught in the "least restrictive environment, appropriate for that individual child." This means the teaching environment should:

- Be designed to meet a child's specific needs and skills
- Minimize restrictions on the child's access to typical learning experiences and interactions

Educating people with autism often includes a combination of one-on-one, small group, and regular classroom instruction.

Individualized Education Program (IEP)




The special education team in your child's school will work with you to design an IEP (also called an individualized education plan) for your child.² An IEP is a

written document that:

- Lists individualized goals for your child
- Specifies the plan for services your child will receive
- Lists the developmental specialists who will work with your child

Qualifying for Special Education


To qualify for access to special education services, the child must be evaluated by the school system and meet specific criteria as outlined by federal and state guidelines. To learn how to have your child assessed for special services, you can:

- Contact a local school principal or special education coordinator
- Visit the [Center for Parent Information and Resources](http://www.parentcenterhub.org/) (<http://www.parentcenterhub.org/>)  ([/Pages/external-disclaimer.aspx](http://www.parentcenterhub.org/Pages/external-disclaimer.aspx))

Consult a parents' organization to get information on therapeutic and educational services and how to get these services for a child. Visit the [Resources and Publications: For Patients and Consumers](http://www.parentcenterhub.org/health/topics/autism/more_information/Pages/resources.aspx) ([/health/topics/autism/more_information/Pages/resources.aspx](http://www.parentcenterhub.org/health/topics/autism/more_information/Pages/resources.aspx)) section for a list of these organizations.

Citations



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2. Ten basic steps in special education. (n.d.). Retrieved December 31, 2015, from <http://www.parentcenterhub.org/repository/steps> 

Joint Attention Therapy for Autism

Research shows that many people with autism have difficulty with joint attention, which is the ability to share focus on an object or area with another person. Examples of joint attention skills include following someone else's gaze or pointed finger to look at something.

Joint attention is important to communication and language learning. Joint attention therapy focuses on improving specific skills related to shared attention,¹ (</health/topics/autism/conditioninfo/treatments/Pages/joint-attention.aspx#f1>). such as:

- Pointing
- Showing
- Coordinating looks between a person and an object

Improvements from such treatments can last for years.

Citations



1. Kasari, C., Gulsrud, A. C., Wong, C., Kwon, S., & Locke, J. (2010). Randomized controlled caregiver mediated joint attention intervention for toddlers with autism. *Journal of Autism and Developmental Disorders*, 40(9), 1045–1056.

Medication Treatment for Autism

Currently, there is no medication that can cure autism spectrum disorder (ASD) or all of its symptoms. But some medications can help treat certain symptoms associated with ASD, especially certain behaviors.

NICHHD does not endorse or support the use of any medications not approved by the U.S. Food and Drug Administration (FDA) for treating symptoms of autism or other conditions.

Healthcare providers often use medications to deal with a specific behavior, such as to reduce self-injury or aggression. Minimizing a symptom allows the person with autism to focus on other things, including learning and communication. Research shows that medication is most effective when used in combination with behavioral therapies.¹

The FDA has approved the use of some antipsychotic drugs, such as risperidone and aripiprazole, for treating irritability associated with ASD in children between certain ages.² Parents should talk with their child's healthcare providers about any medications for children with ASD.

Other drugs are often used to help improve symptoms of autism, but they are not approved by the FDA for this specific purpose. Some medications on this list are not approved for those younger than 18 years of age. Please consult the FDA for complete information on the following listed medications.

All medications carry risks, some of them serious. Families should work closely with their children's healthcare providers to ensure safe use of any medication.³

- **Selective serotonin re-uptake inhibitors (SSRIs)**
(<http://www.fda.gov/Drugs/DrugSafety/InformationbyDrugClass/ucm283587.htm>)
 - This group of antidepressants treats some problems that result from imbalances in the body's chemical systems.
 - SSRIs might reduce the frequency and intensity of repetitive behaviors; decrease anxiety, irritability, tantrums, and aggressive behavior; and improve eye contact.
- **Tricyclics**
 - These medications are another type of antidepressant used to treat depression and obsessive-compulsive behaviors.

- These drugs seem to cause more minor side effects than do SSRIs. They are sometimes more effective than SSRIs for treating certain people and certain symptoms.
- **Psychoactive or anti-psychotic medications**
 - These types of medications affect the brain of the person taking them. The anti-psychotic drug risperidone is approved for reducing irritability in 5-to-16-year-olds with autism.
 - These medications can decrease hyperactivity, reduce stereotyped behaviors, and minimize withdrawal and aggression among people with autism.
- **Stimulants**
 - This group of medications can help to increase focus and decrease hyperactivity in people with autism. They are particularly helpful for those with mild ASD symptoms.
- **Anti-anxiety medications**
 - This group of medications can help relieve anxiety and panic disorders, which are often associated with ASD.
- **Anticonvulsants**
 - These medications treat seizures and seizure disorders, such as epilepsy. (Seizures are attacks of jerking or staring and seeming frozen.)
 - Almost one-third of people with autism symptoms have seizures or seizure disorders.

Autism Speaks, one of the leading autism science and family support organizations in the United States, offers a tool to help parents and caregivers make informed decisions about medication. Visit <http://www.autismspeaks.org/science/resources-programs/autism-treatment-network/tools-you-can-use/medication-guide> (<http://www.autismspeaks.org/science/resources-programs/autism-treatment-network/tools-you-can-use/medication-guide>) [🔗 \(/Pages/external-disclaimer.aspx\)](#) for more information.

Creating a Medication Plan

Healthcare providers usually prescribe a medication on a trial basis to see if it helps. Some medications may make symptoms worse at first or take several weeks to work. Your child's healthcare provider may have to try different dosages or different combinations of medications to find the most effective plan.

Families, caregivers, and healthcare providers need to work together to make sure that the medication plan is safe and that all medications have some benefit.

Things to remember about medication:

- Healthcare providers and families should work together to help ensure safe use of medication.

- Not every medication helps every person with symptoms of autism.
- One person with autism might respond to medications differently than another person with autism or than people who don't have autism.
- Some medications have serious risks involved with their use.

Citations



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Other Autism FAQs

Basic information for topics, such as "What is it?" and "How many people are affected?," is available in the [About Autism Spectrum Disorder \(ASD\)](#) (</health/topics/autism/conditioninfo/Pages/default.aspx>) section. Other Frequently Asked Questions (FAQs) that are specific to a certain topic are answered in this section.

Are there disorders or conditions associated with ASD?

Many people with ASD also have one or more other disorders. According to the CDC, many children with an ASD also have an identifiable genetic, psychiatric, neurologic, or metabolic disorder.^{1,2,16} The new DSM-5 diagnostic criteria for ASD specify that the provider's diagnosis of ASD also indicates whether the person with ASD has any other conditions that are commonly associated with ASD.

Some of these co-occurring disorders can include:

- **Epilepsy or seizure disorder.** Many people with autism show signs of epilepsy by adulthood.³ In most cases, medication can control and treat epilepsy effectively.
- **Tuberous sclerosis.** A small percentage of people with ASD also have tuberous sclerosis. This is a disorder that causes non-cancerous tumors to grow in the brain, kidneys, liver, heart, lungs, and skin.^{4,5} People with tuberous sclerosis have some of the same symptoms as some people with ASD, including developmental delay, behavior problems, and seizures.
- **Fragile X syndrome.** A small percentage of people with ASD also have [Fragile X syndrome](#) (</health/topics/fragilex/Pages/default.aspx>), the most common inherited form of intellectual disability.^{6,7} It is caused by a mutation in the gene called *FMR1*, located on the X chromosome.
- **Intellectual disability.** Many people with ASD have an intellectual disability (problems with thinking, remembering, concentrating, or being creative).⁸
- **Anxiety.** Many children with autism also have anxiety disorder.⁹ Each anxiety disorder has different symptoms, but in general, an anxiety disorder causes people to feel excessive and irrational fear and dread. The symptoms usually last longer than 6 months.¹⁰ The National Institute of Mental Health (NIMH) has [information on anxiety disorders](#)

(<http://www.nimh.nih.gov/health/publications/anxiety-disorders/index.shtml>) on its website.

- **Attention deficit hyperactivity disorder (ADHD).** Many children with autism also have ADHD.⁹ ADHD is common in childhood and can continue through adolescence and adulthood. Symptoms include difficulty staying focused and paying attention, difficulty controlling behavior, and hyperactivity (overactivity).¹¹ The NIMH has [information about ADHD](http://www.nimh.nih.gov/health/publications/attention-deficit-hyperactivity-disorder/index.shtml) (<http://www.nimh.nih.gov/health/publications/attention-deficit-hyperactivity-disorder/index.shtml>) on its website.

Many people with ASD also have other conditions that are viewed as less serious. Sleep disorders, allergies, and digestive problems are common in people with ASD, just as in people without autism. Many of these problems are treatable. Treatment for these conditions won't cure autism, but it can improve the quality of life for people who have autism and for their families.

My child was diagnosed with Asperger syndrome under the DSM-4. Does he or she still have it?

Health care providers no longer consider Asperger syndrome to be a valid diagnosis for milder symptoms of autism. Under the American Psychiatric Association's new diagnostic criteria for mental disorders, or the *Diagnostic and Statistical Manual of Mental Health Disorders, 5th Edition (DSM-5)*, people with very severe symptoms of autism and people with milder symptoms who were previously diagnosed with Asperger syndrome now are considered to have the same diagnosis of ASD.

However, if your child has already been diagnosed with Asperger syndrome, he or she should not have to be re-evaluated by a health care provider to receive a diagnosis of ASD.

Some people with the milder form of autism once known as Asperger syndrome consider the diagnostic label to be a part of their identity. There is nothing wrong with continuing to use this term to describe oneself or to identify with a peer group, even though the official diagnostic term has changed.¹²

Is there a link between ASD and vaccines?

Currently, there is no scientific evidence that vaccines or any material used to make or preserve vaccines causes or contributes to ASD. A great deal of research projects have come to the same conclusion, including those

conducted independently and recently.¹³

The Centers for Disease Control and Prevention (CDC), another agency within the U.S. Department of Health and Human Services, conducts and supports most of the federal studies on vaccines and autism. The CDC also provides the most accurate and up-to-date information about research on ASD and vaccines, including studies supported by the federal government and those funded independently.

Visit the CDC's website at <http://www.cdc.gov/ncbddd/autism/topics.html> (<http://www.cdc.gov/ncbddd/autism/topics.html>) for more specific information.

Is secretin a cure for autism?



Secretin (pronounced *sih-CREE-tin*) is a hormone normally made by the small intestine to help digestion.

Currently, the FDA approves a single dose of secretin only to diagnose digestive problems. Secretin is not FDA-approved to diagnose ASD or to treat autism or ASD symptoms.

In the 1990s, news reports described a few people with ASD whose behavior improved after getting secretin during a test for digestive problems.

A **placebo** is a substance that looks like a real drug (such as secretin) but does not actually contain any drug.

However, a series of clinical trials funded by NICHD and conducted through the Network on the Neurobiology and Genetics of Autism: [Collaborative Programs of Excellence in Autism \(/research/supported/Pages/cpea_staart.aspx\)](#) found no difference in improvement between those taking secretin and those taking placebo.^{14,15} In fact, of the five case-controlled clinical trials published on secretin, not one showed secretin as any better than placebo, no matter what the dosage or frequency. No study completed since this initial group of studies has shown a different outcome.

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Nutritional Therapy for Autism

For a variety of reasons, children with autism spectrum disorder (ASD) may not get the nutrition they need for healthy growth and development.^{1,2,3,4} Some children with autism will only eat certain foods because of how the foods feel in their mouths. Other times, they might avoid eating foods because they associate them with stomach pain or discomfort. Some children are put on limited diets in hopes of reducing autism symptoms.

It is important that parents and caregivers work with a nutrition specialist—such as a registered dietitian—or health care provider to design a meal plan for a person with autism, especially if they want to try a limited diet. Such providers can help to make sure the child is still getting all the nutrients he or she needs to grow into a healthy adult, even while on the special diet.

For example, many children with ASD are on gluten-free or casein-free diets. (**Gluten** and **casein** are types of proteins found in wheat and milk products, respectively.) Available research data do not support the use of a casein-free diet, a gluten-free diet, or a combined gluten-free, casein-free diet as a primary treatment for individuals with ASD.⁵

Good Nutrition Is Important

Research shows that children with autism tend to have thinner bones than children without autism.⁶ Restricting access to bone-building foods, such as dairy products, can make it even harder for their bones to grow strong. Working with a health care provider can help ensure that children who are on special diets still get the bone-building and other nutrients they need.

Digestive Problems in ASD

Some people with autism also have digestive problems, such as constipation, abdominal (belly) pain, or vomiting. Some research⁷ suggests that digestive problems occur more often in people with autism than in people without autism, but research is still being done on this topic.^{5,7} Working with a health care provider can help ensure that a diet does not make digestive problems worse.

NICHHD and other agencies and organizations will continue research to learn more about how children with autism grow and if they have specific nutritional needs.

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Occupational Therapy for Autism

Occupational therapy helps people with autism spectrum disorder (ASD) do everyday tasks by finding ways to work within and make the most of their needs, abilities, and interests.¹

An occupational therapist might:¹

- Find a specially designed computer mouse and keyboard to ease communication
- Teach personal care skills such as getting dressed and eating
- Do many of the same types of activities that physical therapists (</health/topics/autism/conditioninfo/treatments/Pages/physical-therapy.aspx>) do

The American Occupational Therapy Association offers several resources related to occupational therapy and autism (<http://www.aota.org/autism>) [. \(/Pages/external-disclaimer.aspx\)](/Pages/external-disclaimer.aspx).

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Parent-Mediated Therapy in Autism

In parent-mediated therapy, parents learn therapy techniques from professionals and provide specific therapies to their own child. This approach gives children with autism spectrum disorder (ASD) consistent reinforcement and training throughout the day. Parents can also conduct some therapies with children who are at risk of autism but are too young to be diagnosed.


Several types of therapies can be parent-mediated activities, including:

- Joint attention therapy
- Social communication therapy
- Behavioral therapy

Studies suggest that parent-mediated therapies might be able to improve the child's communication skills and interactions with others.¹ Researchers are still collecting evidence on parent-mediated therapies.^{2,3,4}

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Physical Therapy for Autism

Physical therapy includes activities and exercises that build motor skills and improve strength, posture, and balance.


For example, this type of therapy aims to help a child build muscle control and strength so that he or she can play more easily with other children.

Problems with movement are common in autism spectrum disorder (ASD), and many children with autism receive physical therapy.¹ However, there is not yet solid evidence that particular therapies can improve movement skills in those with autism.^{2,3}

You can find a physical therapist near you using the American Physical Therapy Association website (<http://aptaapps.apta.org/findapt/default.aspx?UniqueKey=>)  [\(/Pages/external-disclaimer.aspx\)](#).

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Social Skills Training for Autism

Social skills training teaches children the skills they need to interact with others. It includes repeating and reinforcing certain desired behaviors.

The Children's Friendship Training intervention,¹ for instance, helps elementary school-age children improve several social skills:

- Conversation
- Handling teasing
- Being a good sport
- Showing good host behavior during play dates

There are many social skills training programs throughout the United States. For more information on these programs and their effectiveness, visit https://iancommunity.org/cs/what_do_we_know/social_skills_interventions (https://iancommunity.org/cs/what_do_we_know/social_skills_interventions). [↗](#)
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Speech-Language Therapy for Autism

Speech-language therapy can help people with autism spectrum disorder (ASD) improve their abilities to communicate and interact with others.¹

Verbal Skills

This type of therapy can help some people improve their spoken or verbal skills, such as:

- Correctly naming people and things
- Better explaining feelings and emotions
- Using words and sentences better
- Improving the rate and rhythm of speech

Nonverbal Communication

Speech-language therapy can also teach nonverbal communication skills, such as:

- Using hand signals or sign language
- Using picture symbols to communicate (Picture Exchange Communication System)

Speech-language therapy activities can also include ways to improve social skills and social behaviors. For example, a child might learn how to make eye contact or to stand at a comfortable distance from another person. These skills make it a little easier to interact with others.

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Autism Spectrum Disorder (ASD) | NICHD - Eunice Kennedy Shriver National Institute of Child Health and Human Development

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