Spring 5-2007

Autism: Symptoms, Causes, and Treatments

Susan Elizabeth Sapp
University of Tennessee - Knoxville

Running head: AUTISM

Susan Elizabeth Sapp
Bachelor of Arts

Autism: Symptoms, Causes, and Treatments

Susan Sapp

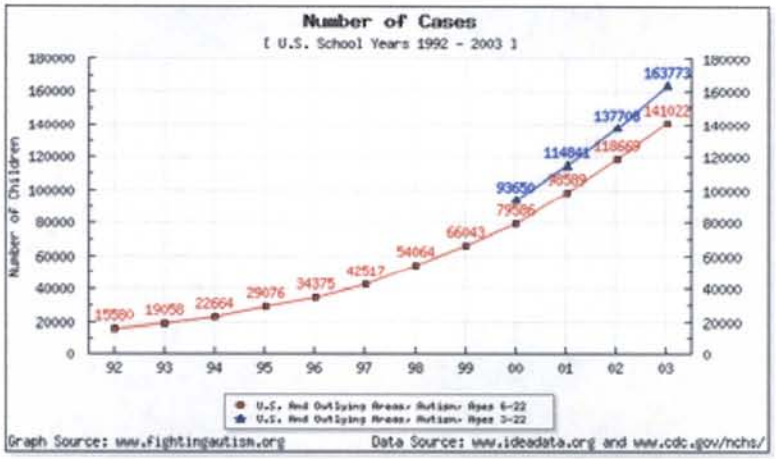
University of Tennessee - Knoxville

Introduction

Waiting in a restaurant, the anxious Charlie is amazed when his younger brother, Raymond, almost instantaneously counts the number of spilled toothpicks on the floor after a waitress drops the box. With skepticism, Charlie tells Raymond he is wrong because Charlie counted 246 toothpicks on the floor, but the box contained 250 toothpicks. Both and waitress and Charlie are in disbelief when the waitress realizes 4 toothpicks are left in the box. This example is one of many examples of the capabilities of an autistic savant. Making a public debut in the movie, Rain Man, the effects of autism were made available to a wide audience across the world. It is considered one of the great movies of our time because of the wonderful acting of Dustin Hoffman in his portrayal of an adult autistic savant named Raymond.

Although this movie made the presence of autism known and acknowledged the debilitating effects of autism, it failed to introduce the more common forms of autism. Most forms of autism are not complimented with a form of genius, such as Raymond's incredible abilities with memorization and numbers.

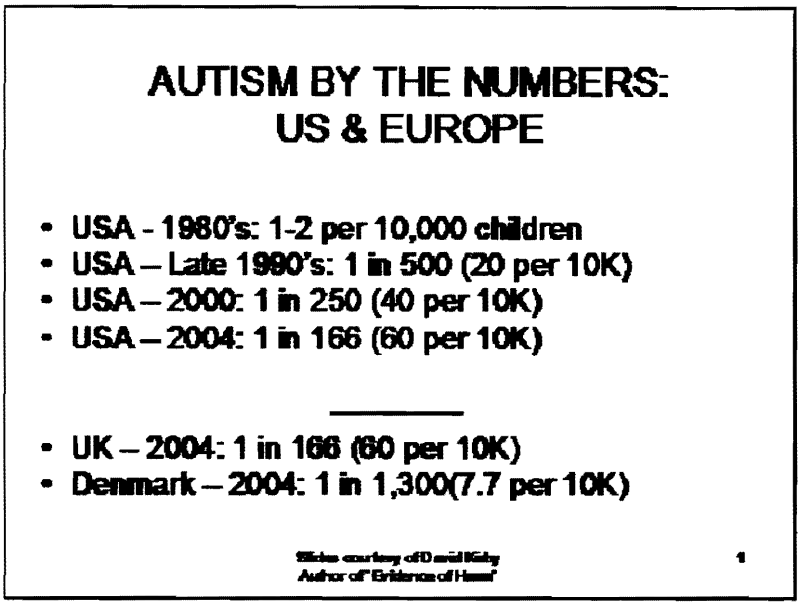
Autism is a bio-neurological developmental disability that affects 1 out of every 160 children born in America (Mothers on a Mission for Autism [MoMA], 2006). The prevalence of autism seems to be rising as awareness of the disease is made more public to both the general populations and to pediatricians and general-practice physicians.



A lifelong developmental disease, autism impacts the way information is processed ("What is Autism," 2000). It appears that while early intervention makes the symptoms of autism less significant, no treatment can completely alleviate the effects of autism. People with autism have "restricted, repetitive stereotyped patterns of behaviors, interests, and activities" ("What is Autism," 2000). In most cases, these symptoms appear before the age of three (MoMA, 2006). Furthermore, in many cases, autism is coupled with other disorders that can create additional symptoms. While many of the signs of autism are known, there is no set description of behaviors that can identify a person with autism. With the growing availability of facts about autism, it is hoped that this disease will be easier to diagnose and treat.

When determining whether a particular child has autism, an important diagnostic tool is the susceptibility of an individual to the disorder. With increasing accessibility of knowledge flowing from the internet and psychological journals, parents and physicians

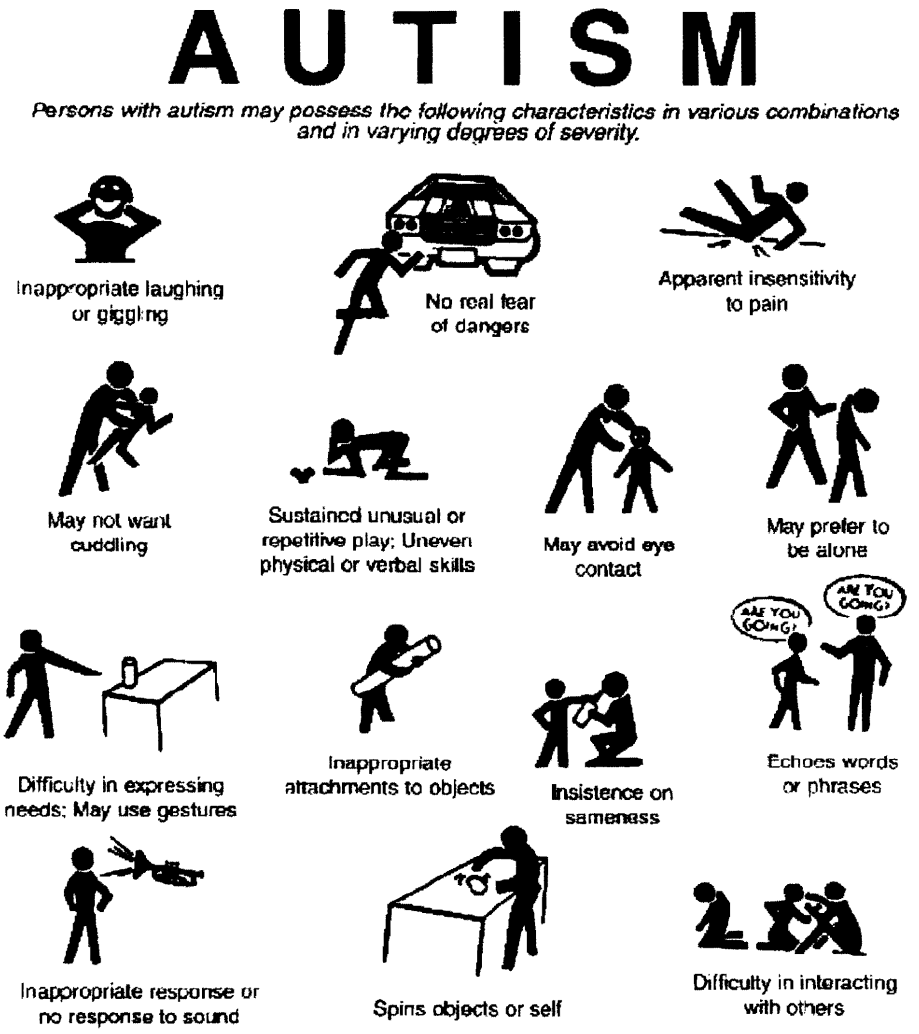
are more likely aware of the chances that their children or patients have autism rather than another similar mental disease. Autism is a disease that affects 0.6% of the American population.



Although this number has risen in recent years, the gender gap in diagnosis remains the same. Boys are diagnosed with autism four times as often as girls (MoMA, 2006). While the disease is more prevalent among males, girls with autism appear to have more severe symptoms and lower intelligence than their autistic male counterparts (MoMA, 2006). Even though gender influences the likelihood of developing this disease, the chances of getting autism are not affected by race, religion, or socio-economic status (MoMA, 2006). The medieval belief that mental disorders are caused by demons has been abandoned. Instead, it is believed that autism is likely caused by a genetic defect that can occur in any individual in any sector of society. With the knowledge that autism is predominant in boys, but that it does not discriminate in race, religion, or socio-economic status, parents and physicians can begin to look for and recognize the symptoms of autism.

Signs and Symptoms

In the movie, Rain Man, Raymond had many of the characteristic symptoms of a person with autism. Those affected with autism "share certain social, communication, motor, and sensory problems that affect behavior in a predictable way" (Strock, 2004). However, not everyone with autism has exactly the same symptoms and deficits (Strock, 2004).



Raymond had many of the classical symptoms such as impaired social interactions and repetitive behaviors, but he was also very gifted with numbers and memorization. People

with autism range from gifted to severely impaired ("What is Autism," 2000). In the more severe cases, acquisition of new knowledge and skills is extremely difficult (Mayo Foundation for Medical Educational and Research [MFMER], 2006). In some cases, people with autism have normal to high intelligence; they "learn quickly, yet [they] have trouble communicating, applying what they know in everyday life, and adjusting to social situations" (MFMER, 2006). Finally, in an extremely small number of individuals with autism, exceptional skills in a specific area are present (MFMER, 2006). These individuals, like Raymond, are known as autistic savants. Because of this range in ability, there is also a range in the amount of assistance those with autism need. People with autism "may eventually live independently or may need supportive living and working environments (MFMER, 2006)." The majority of those affected require assistance: "60 percent of adults with autism continue to need care throughout their lives" (MFMER, 2006). While necessary, the aid required by those with autism does not come cheap: "The cost of the health and educational services to those affected exceeds $3 billion each year" (MoMA, 2006). Autism can have profound effects on those with the disease as well as on the caregivers, family and society.

Given that the best way to improve the condition of someone with autism is through early intervention, recognition of the signs and symptoms of autism is extremely important. People with autism generally have social, cognitive, and behavioral

dysfunction. Communication skills and the "ability to relate to people, events, and objects in the environment" are impaired ("What is Autism," 2000). Furthermore, a slow ability to learn and think is characteristic of autism ("What is Autism," 2000). While not all autistics have the same symptoms, the following is a list of some of the signs someone with autism may show.

Behavioral

- Performs repetitive movements, such as rocking, spinning or hand-flapping (MoMA, 2006)
- Develops specific routines or rituals (MoMA, 2006)
- Becomes disturbed at the slightest change in routines (MoMA, 2006)
- Moves Constantly (MoMA, 2006)
- May be fascinated by parts of an object, such as the spinning wheels of a toy car (MoMA, 2006)
- Does not make eye contact when making requests (MoMA, 2006)
- Speaks with an abnormal tone or rhythm — may use a singsong voice or robot-like speech (MoMA, 2006)
- Crying tantrums: Extreme distress for no discernible reason ("What is Autism," 2000)
- Marked physical over activity or extreme passivity ("What is Autism," 2000)
- Inappropriate attachment to objects ("What is Autism," 2000)
- Sustained odd play ("What is Autism," 2000)
- Inappropriate laughing and giggling ("What is Autism," 2000)
- Remains fixated on a single item or activity (MFMER, 2006)
- May sniff or lick toys (MFMER, 2006)

- Physically attack and injure others without provocation (MFMER, 2006)
- Inaccessible, as if in a shell (MFMER, 2006)

Cognitive

- Starts talking later than other children (MoMA, 2006)
- Loses previously acquired ability to say words or sentences (MoMA, 2006)
- Can't start a conversation or keep one going (MoMA, 2006)
- Echolalic: may repeat words or phrases verbatim, but doesn't understand how to use them (MoMA, 2006)
- May be unusually sensitive to light, sound and touch (MoMA, 2006)
- Unusual perceptual stimuli: "Looking through people" ("What is Autism," 2000)
- Apparent insensitivity to pain ("What is Autism," 2000)
- Shows no sensitivity to burns or bruises (MFMER, 2006)
- May engage in self-mutilations such as eye-gouging (MFMER, 2006)
- Uneven fine/gross motor skills: May not be able to kick a ball but can stack blocks ("What is Autism," 2000)
- No fear of real dangers ("What is Autism," 2000)
- Lack of speech or impaired speech ("What is Autism," 2000)
- Resists normal teaching methods ("What is Autism," 2000)

Social

- Fails to respond to his or her name (MoMA, 2006)
- Has poor eye contact (MoMA, 2006)

- Appears not to hear you at times (MoMA, 2006)
- Resists cuddling and holding (MoMA, 2006)
- Appears unaware of others' feelings (MoMA, 2006)
- Seems to prefer playing alone – retreats into his or her "own world" (MoMA, 2006)
- Difficulty in mixing with other children ("What is Autism," 2000)
- Standoffish manner ("What is Autism," 2000)
- Acts as if unaware of the coming and going of others (MFMER, 2006)

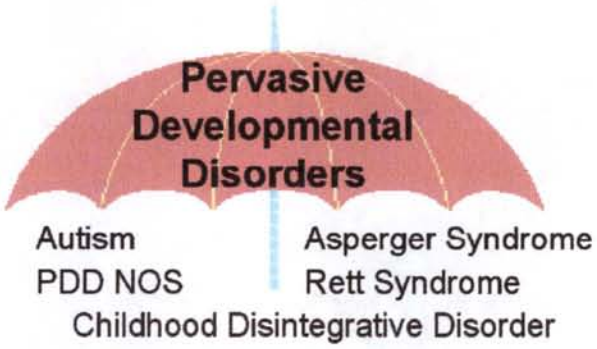
Although the primary symptoms of autism are social, cognitive, and behavioral, many people who have this mental disorder have physical ailments as well. In 30% of children with autism, the following physical problems may also occur: allergies, asthma, epilepsy, digestive disorders, sleeping disorders, attention deficit/hyperactivity disorder, diabetes, heavy metal toxicity, and/or seizures (Picciotto et al., 2006). Autism may also be coupled with sensory integration disorder. People with this disorder have trouble processing information from the proprioceptive, visual, vestibular, oral, auditory, and tactile sensory organs (MoMA, 2006). In addition, autism may cause poor balance, poor posture, and chronic pain because of the muscle stiffness and muscle weakness that can accompany this disease (MoMA, 2006).

Furthermore, people with autism may have persistent viral infections caused by poor immune functioning (MoMA, 2006). Although it is often thought of as disease that affects the mental state, it is apparent that the disease is not limited to social, behavioral, and cognitive dysfunction. Autism can be very debilitating on all facets of life.

In addition to the physical ailments that may accompany autism, there are also several genetic disorders that can be coupled with autism. In 10% of the autistic population, other disorders are present (Picciotto et al., 2006). Some of the common disorders are fragile X syndrome (the cause of mental retardation), tuberous sclerosis (the cause of tumor growth on the brain), and tourettes syndrome (the cause of involuntary movements and vocalizations) (MoMA, 2006). Other disorders that may appear in conjunction with autism include Angelman's syndrome, phenylketouria, Joubert syndrome, and Mobius syndrome (Picciotto et al., 2006). These disorders may exacerbate the already present symptoms of autism. The chance to live a semi-autonomous life decreases if a person is affected with more than one disorder. While the potential effects of having multiple disorders may be devastating, this information does shed light on the potential causes of autism.

Causes

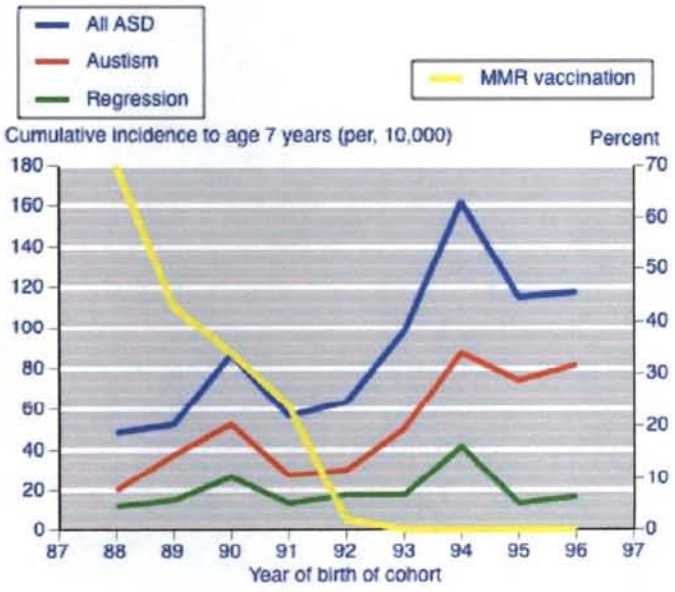
While the exact causes of autism continue to be sought out, the presence of the disease has been known for many years. "In 1943, Dr. Leo Kanner of the John Hopkins Hospital introduced the label early infantile autism into the English language" (Strock, 2004). Around the same time, Dr. Hans Asperger, a German scientist, described a milder form of early infantile autism that later became known as Asperger syndrome (Strock, 2004). It was not until many years later that the Diagnostic and Statistical Manual of Mental Disorders reported autism as a disorder. The DSM-IV-TR (fourth edition, text revision) now lists five pervasive developmental disorders that are often referred to as autism spectrum disorders (Strock, 2004).



These pervasive disorders, such as Rett syndrome, Childhood disintegrative disorder, and Asperger syndrome, are "characterized by varying degrees of impairment in communication skills, social interactions, and restricted, repetitive and stereotyped behaviors" (Strock, 2004). While there has been a developing understanding of the symptoms of the disorder, there has also been an emerging insight into the causes of autism. Years ago, "it was believed that autism resulted from bad parent-child

interactions" (Picciotto et al., 2006). As knowledge about autism has increased, this idea has been replaced with more biological approaches.

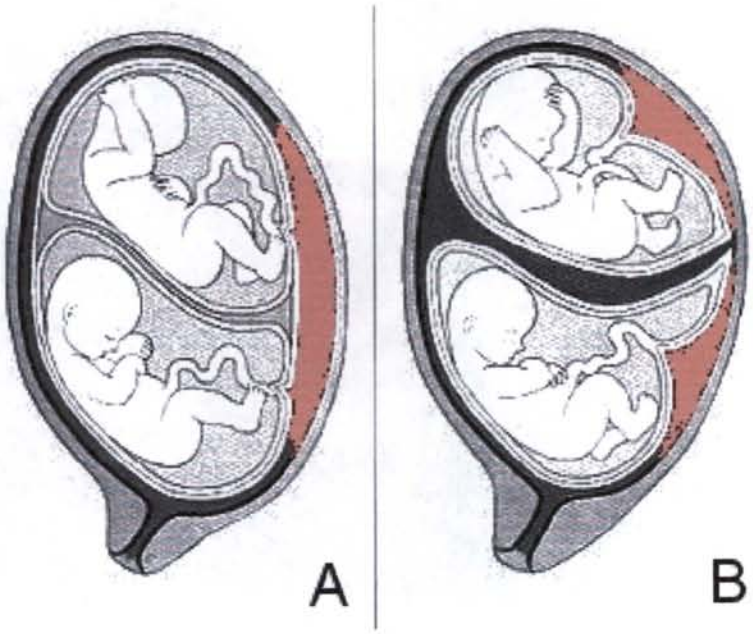
While genetic defects and brain abnormalities are the commonly accepted causes of autism, the possible adverse side effects of immunizations have received a lot of attention as a cause of autism. The vaccine for measles-mumps-rubella (MMR) has been implicated as a possible cause for autism (MoMA, 2006). Vaccines that contain thimerosal, a preservative that contains a very small amount of mercury, are thought by some to trigger the onset of autism (MoMA, 2006). However, many studies have refuted the claim that vaccines are the culprit (Fombonne & Chakrabarti, 2001).



The graph above illustrates the increase in cases of autism and other autism spectrum disorders even after the cessation of the MMR vaccination. Evidence shows that MMR vaccinations are helpful, rather than harmful to the children who receive them

(Fombonne & Chakrabarti, 2001). By ruling out the vaccination theory, scientists can begin to focus on the more likely causes of autism, genetic defects.

Geneticists and researchers have been able to conclude that genetic defects are the cause of autism from the results of studies completed on families that have an autistic family member. In families with one autistic child, parents have a one in twenty chance of having a second child with the disorder (MFMER, 2006), an eightfold increase compared to the general population. Furthermore, "relatives of autistic children may show mild impairments in social and communication skills or engage in repetitive behaviors" (MFMER, 2006). These family members are not labeled with autism, but they do share some of the characteristic behaviors of a person with autism. Social deficits, language abnormalities, and psychiatric disorders are part of the family history of people with autism (Picciotto et al., 2006). Twin studies have provided more persuasive support to a genetic link. In 1977, Folstein and Rutter "demonstrated that there was a higher concordance rate among monozygotic twins than dizygotic twins" (Picciotto et al., 2006).

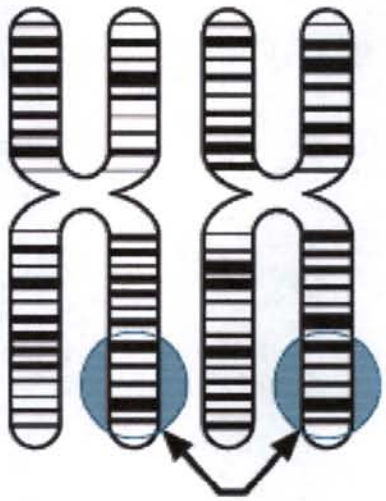


Because monozygotic twins (A) share the same genetic make-up, whereas dizygotic twins (B) are no more related than siblings, the research points to a genetic cause rather than an environmental cause. With this information, geneticists have tried to understand the method of inheritance of this disorder. The transmission of the disorder from male-to-male in a number of families rules out the possibility of X-linkage as the prevailing mode of inheritance (Muhle, Trentacoste & Rapin, 2004). Instead, autosomal recessive inheritance has been suggested (Smalley, 1991). Despite theories on the mode of inheritance, the gene or genes responsible for autism have not been precisely located. Thus, autism is believed to be polygenic (Picciotto et al., 2006). Many genes "have been suggested for (their) functional role, location within a candidate chromosome, and positive association with the disease, but replications are elusive" (Picciotto et al., 2006).

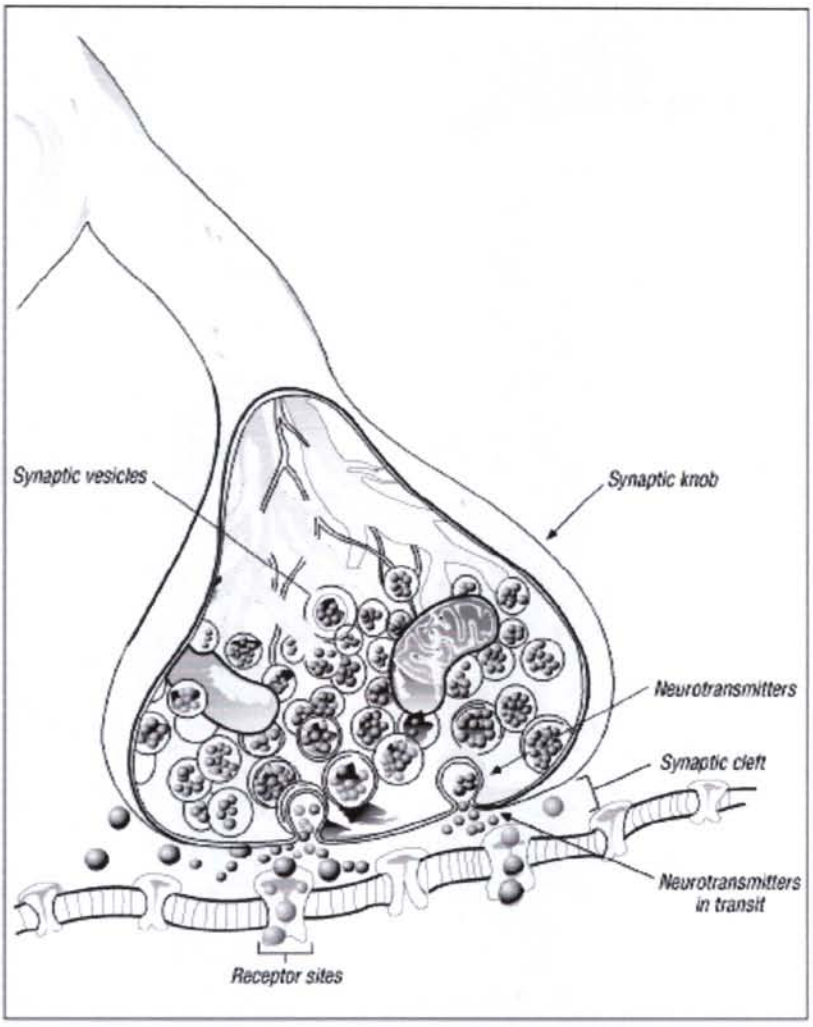
It is "likely that multiple genes are interacting with one or more environmental factors" to produce autism (Picciotto et al., 2006). Thus, merely having the genetic code for autism does not guarantee that it will develop. Data collected from whole-genome screening in multiplex families (familes with >1 affected family member) suggest that autism is caused by the interactions of at least 10 genes (Muhle et al., 2004). Pinpointing the

genetic source is difficult because environmental cues may be involved and because the exact clinical phenotypes of autism remain elusive. There is not an exact description of how a person with autism behaves or thinks. This variation in phenotype makes it difficult to find the exact genotype involved (Smalley, 1991). However, this has not stopped researchers from trying to locate the genes involved in autism.

By comparing the genomes of those affected by autism, the possible gene loci responsible for causing autism may be found.



The "most consistently replicated linkage findings have been on chromosomes 7q, 2q, and 15q (Santangelo & Tsatsanis, 2005)." The putative speech and language region, 7q31-q33 has been implicated in autism (Muhle et al., 2004). This could explain why children with autism have difficulty in learning and maintaining a vocabulary. Chromosome 15 duplications have been suggested as culprits in the search for the cause of autism (Muhle et al., 2004). The GABA(A) receptor subunit and UBE3A genes on chromosome 1511-q13 as well as the oxytocin receptor at 3p25-p26 have variant alleles more often in the autistic population than in the nonautistic population (Muhle et al., 2004).



Furthermore, variant alleles of the serotonin transporter gene, 5-HTT, on chromosome 17q11-q12 have been pinpointed as possible causes (Muhle, et al., 2004). The genes FOXP2, RAY1/ST7, IMMP2L, RELN at 7q22-q33 and the 15q11-q13 locus have also shown to be abnormal in those with autism (Muhle et al., 2004). The extensive number of implicated genes shows the complexity of the genetic causes behind autism. With the knowledge that autism in polygenic, researchers are slowly learning what interactions between genes and the environment can cause autism.

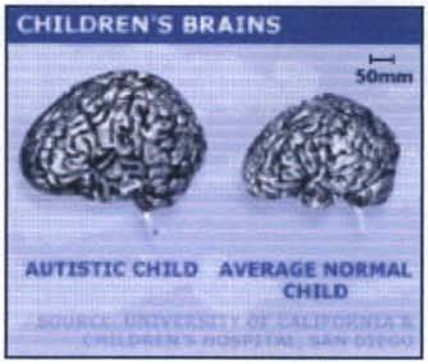
It appears that certain environmental cues can trigger the onset of autism. The prenatal environment can greatly affect whether a child with a specific genetic composition will acquire autism.

In one case-control study by Deykin and MacMahon, "maternal reports and medical records of illness during pregnancy showed relative risks of 4.1 for influenza and 3.3 for rubella (as cited in Picciotto et al., 2006)." Chess et al. (1978) examined a cohort of about 250 children with congenital rubella and found that 7% were later diagnosed with autism (as cited in Picciotto et al., 2006). Rubella may play a large role in causing autism according to Deykin, MacMohon, and Chess et al. In a different epidemiology study by Hultman et al. (2002), a link between daily maternal smoking during early pregnancy and autism was reported (as cited in Picciotto et al., 2006). Further studies have not replicated the findings by Hultman et al.; therefore, other factors may have confounded his results. In studies by Rodier and Hyman (1998), a link between autism and early *in utero* exposure to thalidomide at the time of neural tube closure in the fourth or fifth week of gestation was discovered (as cited in Picciotto et al, 2006). Gestational exposure

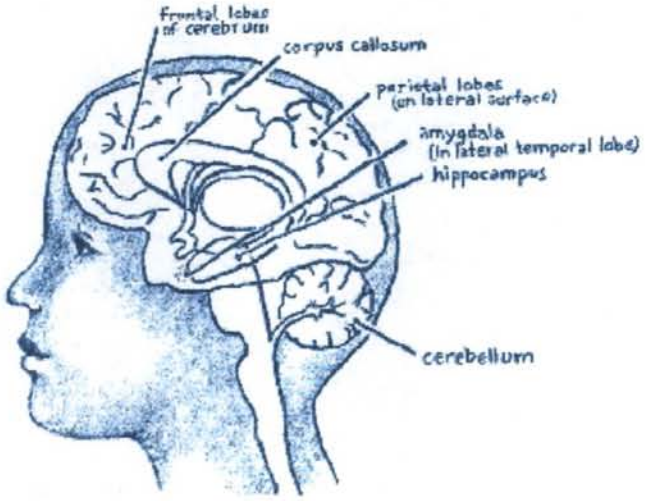
to valproic acid, as well as maternal infections of cytomegalovirus, measles, mumps, or herpes may account for a small number of autism cases (Picciotto et al., 2006).

The prenatal environment, depending on the conditions, plays a huge role in triggering autism. It has also been found that toxic exposure and teratogens in the environment may be linked to a small number of autism cases (Muhle et al., 2004). Microbial and chemical substances appear to play a prominent role in initiating autism. Thus, though genetic defects are largely involved, environmental cues contribute to the onset of this disorder.

When the disorder begins to manifest itself, brain abnormalities appear in those affected. These "brain abnormalities often occur before 30 weeks of gestation" (Halsey, Hyman & Conference Writing Panel, 2001). In fact, it appears that abnormal cell migration between the third and fifth months of gestation can lead to cerebellar abnormalities recognized in people with autism (Picciotto et al., 2006). Furthermore, a possible sudden, rapid head growth during infancy may be an early warning sign that autism is developing (Strock, 2004).



The amygdala, hippocampus, and corpus callosum are the regions of the brain that appear to be most affected during the development of autism (Picciotto et al., 2006). Another major brain region, the cerebral cortex, seems to have disorganized columns in persons affected with autism (Picciotto et al., 2006).



While the brain structures of people with autism are altered, so are the individual neurons that make up these structures. For example, "the distribution of neuropeptides and neurotrophins at birth (is) altered in children who later develop autism" (Picciotto et al., 2006). Furthermore, children with autism have a dysfunctional myelination process (Folstein & Piven, 1991). To explain these brain abnormalities, the growth dysregulation hypothesis has been introduced. According to the hypothesis, "anatomical abnormalities are caused by genetic defects in brain growth factors" (Strock, 2004).

Knowing which areas of the brain are affected may help researchers discover what genes are responsible for autism.

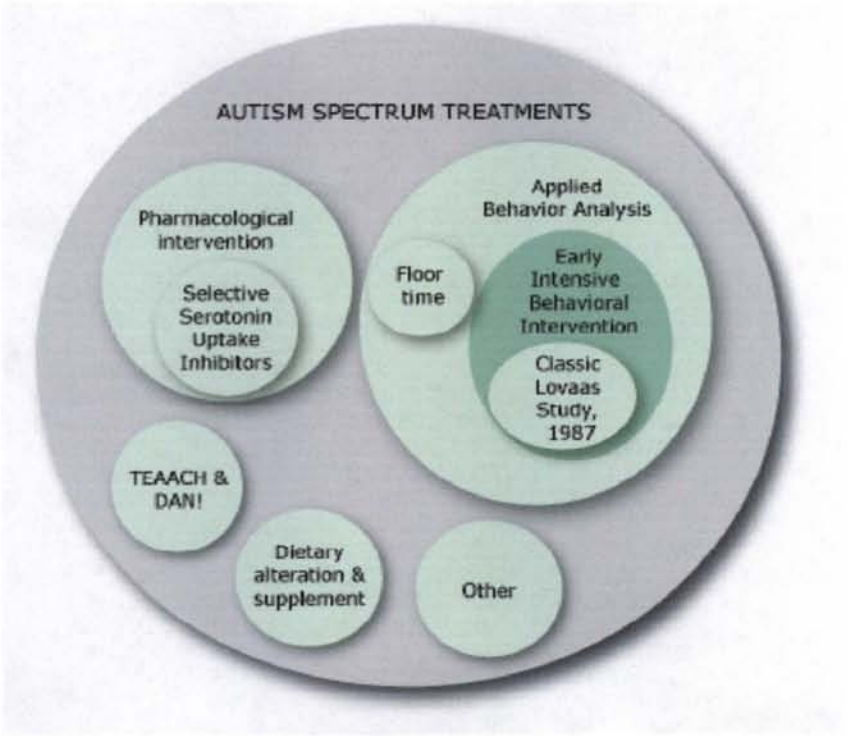
Autism does not stop its effects in the brain; the immune system of people with this disorder seems to be affected as well. Many neuroimmunomodulatory factors differ in individuals with or without autism. The profile of cytokines, activation of leukocytes, and other immunological parameters are dissimilar in persons with autism (Picciotto et al., 2006). Children with autism have 20% more B cells and 40% more natural killer cells than children without autism (Reuters, 2005).

In a study by Dr. Judy Van de Water, the immune cells of children with and without autism were mixed with toxins and bacteria. In response to bacteria, cytokines, or the immune signaling proteins, were produced in lower levels in the group with autism, but the two groups did not react differently to toxins (Reuters, 2005). The low level of cytokine production in response to bacteria is deleterious to persons with autism and may account for the poor immune functioning of people with this disorder. Research into the different immunological cellular components of people with autism is hoped to create a

diagnostic blood test that can identify people with autism. With an early diagnosis, intervention and treatment can begin quickly for people with autism.

Treatment

Autism, while it can be treated, has no cure. However, when begun at an early age, treatment has proven to be very effective in reducing the symptoms of autism. The goal of treatment is to teach skills and behaviors that will allow autistics to function within the confines of the disorder (MFMER, 2006). The treatment for autism is multifaceted because this disorder has both biological and behavioral components.



For many people with autism, a regimen of vitamins and medication, as well as multiple therapies, are employed to reduce the symptoms of autism. With early treatment, many autistics have higher functioning and can also learn skills that will help them cope with the disorder.

In many children with autism, intervention is begun early so that they can begin to improve behavioral and social skills. In some cases, children with autism are placed in highly structured education programs with a team of specialists (MFMER, 2006). In these programs, children are offered a variety of activities and therapies. Physical therapy is implemented to improve motor skills, coordination, and balance (MoMA, 2006).

Occupational therapy is used to introduce and improve age-appropriate self-help and coping skills in order to give children with autism a better meaning of life (MoMA, 2006). Speech and communication therapies improve language skills and vocabulary of children with autism (MFMER, 2006). Music therapy promotes communication, relationships, learning, mobilization, expression, and organization while stimulating many areas of the brains (MoMA, 2006).

Sound therapy, much like music therapy, can improve a child's ability to communicate, recognize frequencies, maintain eye contact, and respond to others (MoMA, 2006). Vision therapy helps children integrate peripheral and central vision processing, improve perceptual ability, and increase attention span (MoMA, 2006). Animal therapy helps to develop a child's motor skills and emotional relationships (MoMA, 2006).

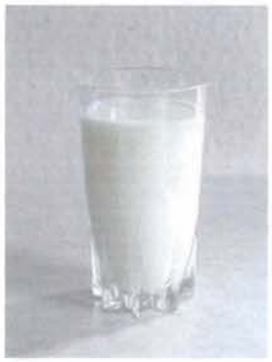
Recreational therapy builds social and motor skills in children with autism. All therapies work to decreases a child's hypersensitivity to touch or sound and improve sensory integration (MoMA, 2006). These programs teach children how to cope with autism and they provide skills necessary for social interactions.

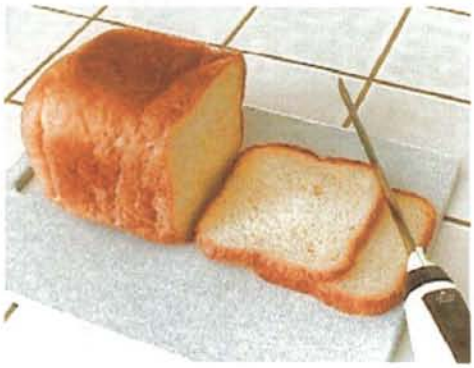
Along with therapeutic treatments, many children with autism begin behavioral modification programs designed to change the autistic behaviors considered abnormal by society. The behavioral modification programs available include, but are not limited to, LOVAAS, ABA, TEACCH, and SONRISE. Each of these programs attempts to perfect certain skills and reduce problem behavior through learning techniques (MFMER, 2006). LOVAAS is an intervention that takes place at home by "shaping behavior through reinforcement of successive approximations, prompting and fading procedures, and use

of positive reinforcers (ie. praise, playing with a favorite toy, small bites of food) that are child specific and functional" ("What and How We Teach," 2005). Reduction of inappropriate behaviors occurs through teaching alternate, more socially acceptable forms of communicating the same needs ("What and How We Teach," 2005). The ABA method attempts to improve life quality by enabling autistics to live regular lives in natural settings with valued participation in the community ("About IABA," 2001). The TEACCH behavioral management program teaches children self care skills in a modified environment using the children's affinity for routines and rituals to reinforce behavior ("Autism Treatments," 2003). This method is recommended for low-functioning autistic children because prepares the child for some degree of lifelong institutional involvement ("Autism Treatments," 2003). Finally, the SONRISE method implements effective education techniques that jump-start speech and language development, promote formation of warm relationships, move through challenging behavior (e.g., tantrums or hitting), and enable children to move beyond repetitive behaviors ("About Son-rise," 1998).

Although each of these methods varies in how it is applied, each attempts to teach people with autism new skills that will help them in their everyday lives.

Another aspect of autism that is separate from behavioral therapies and modification programs is the biological component of autism. Special diets and medications have been shown to improve the symptoms of autism. One such diet is the gluten free/casein free diet; this diet entails removing all wheat protein, gluten, and all milk protein, casein, from the child's meals (MoMA, 2006).





The byproducts of these proteins have been found in the urine of children with autism, so it is possible that children with autism cannot process these proteins (MoMA, 2006). It has also been found that adding certain vitamins and supplements to the diet of a person with autism improves symptoms. Mega doses of vitamin B6 and DMG or TMG may improve certain biochemical imbalances and improve sensory deficiencies (MoMA, 2006). For example, addition of DMG supplements to the diet has "indicated improvements in the areas of speech, eye contact, social behavior, and attention span" ("Autism Treatments," 2003). Vitamin B6, on the other hand, seems to control hyperactivity ("Autism Treatments," 2003). While certain diets and vitamin/supplement therapies improve the symptoms of some children, these treatments are very child specific (MoMA, 2006). While these nutritional regimens help some people with autism, others do not respond well. However, if this treatment does work, people with autism have greatly improved symptoms when the diet is paired with therapy.

Medication, like vitamins and minerals, can improve the symptoms of autism. The symptoms treated by medications are generally secondary symptoms of autism such as seizures and depression ("Autism Treatment," 2003). The clinical symptoms may vary with different chronological ages (Tsai, 1999). For example, a child with hyperactivity or irritability may later develop symptoms of depression or obsessive-compulsive disorder. As behaviors vary, the medications may also change, but the reason for psychotherapeutic medication remains the same: certain drugs are prescribed to eliminate "the psychiatric or behavioral symptoms that are interfering with the individual's ability to participate in educational, social, work, and family systems as well as to enhance the positive response to other forms of intervention in persons with autism" (Tsai, 1999).

Medication	Symptom	Commonly Prescribed Drugs	Percent Affected
Antipsychotic medications	severe aggression, self-injuring behavior, agitation, or insomnia	Mellaril, Haldol, Thorazine	9 - 44%
Anticonvulsant medications	Seizures	Tegretol, Depakote, Dilantin	25-33%
Antidepressants	bipolar manic depression	Lithium, Depakote	9 - 44%
Monoamine Oxidase Inhibitors (MAOIs)	depression and panic	Phenelzine (Nardil), Moclobemide (Manerix)	9 - 44%
Selective Serotonin Reuptake Inhibitors (SSRIs)	depression and compulsive behaviors	Fluoxetine (Prozac), Paroxetine (Paxil)	16 - 86%
Beta Blockers	aggression and hyperactivity	Nadolol, Buspirone	40%
Opiate blockers	Self-injuring behavior	Naltrexone/Trexan	24 - 43%
Sedatives	insomnia	Chloral Hydrate, Noctec, Benadryl	11%
Stimulants	hyperactivity and attention or concentration problems	Ritalin, Dexedrine	60%
Antianxiety medications	anxiety and fear	Valium, Librium	17 - 74%

("Autism Treatment," 2003, Tsai, 1999, MoMA, 2006)

Many of these drugs tend to have side effects that are worse than the initial symptoms. For example, drugs such as Nadolol, Ritalin, and Lithium can cause abdominal cramping. If bad side effects do occur, other medications are considered until the best alternative is found. However, in many cases, medications can greatly improve the quality of life of someone with autism.

Conclusion

In the nearly 65 years since autism has been named, quite a bit of information has been gathered on what defines autism, what causes autism, and how best to treat autism. This bio-neurological developmental disorder influences cognitive functioning and behavioral patterns. Many people with autism have similar behaviors and crippled social interactions. These symptoms are likely caused by a set of genes that are defective. The onset of symptoms can be triggered by certain environmental factors, usually during the time that the individual is *in utero*. As the disorder begins to manifest, brain abnormalities and other disorders may begin to appear. However, treatments such as therapy, behavioral modification, vitamin/supplement therapy, and medication can greatly improve the symptoms of autism. The future treatment options for autism are expanding. When a specific autistic phenotype can be established, perhaps the exact

genotype of autism can be discovered. When this occurs, treatment may improve by leaps and bounds.

REFERENCES

About IABA. (2001). Retrieved November 8, 2006, from http://www.iaba.com/

About Son-rise. (1998). Retrieved November 8, 2006, from http://www.autismtreatmentcenter.org/contents/other_sections/index.php.

Autism Treatments. (2003). Retrieved November 8, 2006, from http://www.autism-pdd.net/autism-treatments.html.

Chakrabarti, S., & Fombonne, E. (2001). No Evidence for a New Variant of Measles-Mumps-Rubella-Induced Autism. *Pediatrics, 108*, E58.

Clark County Service Department. (2000). *What is Autism?* Retrieved September 15, 2006, from http://www.ccsd.net/sssd/autism/facts.html.

Folstein, S.E., & Piven, J. (1991). Etiology of Autism: Genetic Influences. *Pediatrics, 87*, 767-773.

Halsey, N.A., Hyman, S.L., & Conference Writing Panel. (2001). Measles-Mumps-Rubella Vaccine and Autistic Spectrum Disorder: Report from the New Challenges in Childhood Immunizations Conference Convened in Oak Brook, Illinois, June 12-13, 2000. *Pediatrics, 107*, E84.

Mayo Foundation for Medical Education and Research. (2006). *Children's Health: Autism*. Retrieved September 15, 2006, from http://www.mayoclinic.com/health/autism/DS00348/DSECTION=1.

Moms on a Mission for Autism. (2006). *Autism*. Retrieved September 15, 2006, from http://www.momsonamissionforautism.org.

Muhle, R., Trentacoste, S.V., & Rapin, I. The Genetics of Autism. *Pediatrics, 113*, 472-486.

Picciotto, I.H., Croen, L.A., Hansen, R., Jones, C.R., Van de Water, J., & Pessah, I.N. (2006). The CHARGE study: An Epidemiologic Investigation of Genetic and Environmental Factors Contributing to Autism. *Environmental Health Perspective, 114*, 1119-1125.

Reuters. (2005). Immune Systems may be Affected by Autism. Retrieved October 8, 2006, from http://www.msnbc.msn.com/id/7748032/.

Santangelo, S.L., & Tsantsanis, K. (2005). What is known about Autism: Genes, Brain, and Behavior? *American Journal of Pharmacogenomics, 5*, 71-92.

Smalley, S.L. (1991). Genetic Influences in Autism. *Psychiatric Clinics of North America, 14*, 125-139.

Strock, Margaret. (2004). *Autism Spectrum Disorders (Pervasive Developmental Disorders)*. Retrieved September 15, 2006, from http://www.autismlink.com/info/signs_symptoms.php.

Tsai, Luke Y. MD. (1999). Psychopharmacology in Autism. *Psychosomatic Medicine, 61*, 651-665.

What and How We Teach. (2005). Retrieved November 8, 2006, from http://www.lovaas.com/lovaas_model.php.