

## **Evidence Shows Vaccines Unrelated to Autism**

Many parents have heard claims that vaccines cause autism. The most common and specific claims are that autism stems from the measles-mumps-rubella (MMR) vaccine or from vaccines that contain the preservative thimerosal. Many large studies have been conducted to investigate these specific concerns, but no link has ever been found between vaccines and autism. Still, these disproven claims persist, and they have led some parents to refuse vaccination for their children. The causes of autism are not fully understood, but overwhelmingly, scientific evidence does not point toward vaccines as a possible cause. The information that follows lays out scientific evidence that (1) refutes claims that any relationship exists between vaccines and autism and (2) presents some of the current thinking on the causes of autism.

### **Medical and legal authorities agree that no evidence exists that vaccines cause autism.**

In 2004, the Institute of Medicine—a prestigious group of impartial experts who advise Congress on science issues—stated strongly that the evidence from five large epidemiological studies, three of which involved more than 100,000 children each, did not support a connection between autism and thimerosal-containing vaccines. Similarly, evidence from 14 large epidemiological studies showed no association between measles-mumps-rubella (MMR) vaccine and autism. Since that time, even more studies have reinforced the conclusion that there is no evidence for a connection between vaccines and autism. In 2009, after extensive proceedings that generated 5,000 pages of transcript and included 939 medical articles, the federal court that administers the National Vaccine Injury Compensation Program found the scientific evidence is “overwhelmingly contrary” to the theory that autism is linked to MMR vaccine, thimerosal, or a combination of the two. The World Health Organization, the European Medicines Agency, Health Canada, and other national and international health groups have all dismissed the possibility of a link between vaccines and autism.

### **The causes of autism are not fully understood, but the evidence does not point toward vaccines.**

The influence of vaccines on a child cannot explain the measurable differences in brain structure and brain function that exist between autistic and non-autistic children. Starting in the first six months of life, many autistic children experience unusually rapid growth in areas of the brain that are responsible for the skills typically impaired in autism. Researchers have used “functional” MRI scans to study the connections of nerve cells within the brains of autistic individuals. These scans show—in very young autistic infants and toddlers—abnormal connections in areas of the brain that control language, social, and emotion processes, suggesting that these abnormalities contribute to the development of autism. The results of these and other studies provide promising clues for future research on the causes of autism and emphasize that finding its causes will not be as simple as pointing to vaccines as the cause.

What is known with great certainty is that genetics play a major role in determining whether a child will be autistic. The study of twins bears this out. Identical twins have 100% of their genes in common; fraternal twins have 50% in common (like any other pair of siblings). In more than three out of four cases, when one identical twin has a form of autism, the other one does too. Among fraternal twins, though, this is true for one out of about seven pairs, at most. A child who has one or more older siblings with autism is between 20 and 50 times more likely to be diagnosed with a form of autism, compared with a child who has no autistic older siblings. In addition, in families affected by autism, many parents and non-autistic siblings display mild autistic-like traits. The inherited or spontaneous mutations that seem to be associated with autism are in genes that control the development of the brain—including how brain cells develop and make circuits that operate correctly. This finding agrees with the discovery of abnormalities in the way the brain operates even in very young infants and toddlers with autism.

**Autism is present before it becomes apparent to a child's family.**

Parents often first notice the behaviors of autism when their child is 18–24 months old—the age by which most childhood vaccines have been given. Because of this, many parents incorrectly associate vaccination with the onset of autism. Developmental specialists, however, can identify early signs of autism in children when they are much younger, before their parents have noticed anything unusual. This research supports the scientific consensus that, in most cases, the precursors of autism are present before a child is born.

**A baby's immune system can easily handle the vaccines recommended for infants and toddlers.**

Some people worry that receiving too many vaccines early in life can overwhelm a baby's immune system and that this might somehow lead to autism. This doesn't fit with what we know about the remarkable capacity of the immune system. From the moment of a baby's birth, the immune system begins coping with microorganisms in the form of bacteria, viruses, and fungi. Like vaccines, these microorganisms contain foreign antigens—proteins that stimulate the immune system. When you realize that a single bacterium contains a larger variety and number of antigens than are found in all the recommended early childhood vaccines combined, you can see that a baby's immune system, which copes with exposure to countless bacteria each day, can easily withstand exposure to the antigens in vaccines.

**Vaccines contain only the components necessary to make them work safely.**

Vaccines contain a few components, such as formaldehyde and aluminum, that may sound dangerous until you understand that everything in a vaccine is there either because it helps the vaccine do its job or because it is part of making the vaccine. For instance, some vaccines contain a very small quantity of formaldehyde, which is used in vaccine manufacturing to deactivate viruses so they can provide immunity without causing disease. Though formaldehyde may sound dangerous, it is actually a natural byproduct of the normal functioning of human cells. The amount of formaldehyde found in vaccines is much less than the amount found in a healthy human body at any given time. Aluminum is an important component of some vaccines. It is an adjuvant, an ingredient that makes it possible for the vaccine to contain a smaller dose of its core substance (called an antigen) and still protect against disease. Aluminum is the most plentiful substance in the Earth's crust. One dose of vaccine contains about as much aluminum as a quart of baby formula does. People have heard rumors that vaccines contain antifreeze. They do not.

**Many studies have looked for a link between thimerosal-containing vaccines and autism, but none has been found.**

A mercury-containing compound, thimerosal has been used since the 1930s as a vaccine preservative in vials that contain several doses of vaccine (called multi-dose vials). Before giving a vaccine, a healthcare professional inserts the needle of the syringe that will be used to administer the vaccine into the stopper of the multi-dose vial and draws out a single dose of vaccine. When the needle pierces the stopper, it is possible that contaminants from outside the vial might be introduced, even when sterile technique is used. Thimerosal keeps bacteria or other microorganisms that might have entered the vaccine vial from multiplying. Studies to determine if a relationship exists between thimerosal-containing vaccines and autism have taken two different approaches: (1) some examined groups of children who had received childhood vaccines that contained varying amounts of thimerosal. Autism occurred at essentially the same rate no matter how much or little thimerosal the children had received. (2) Other studies took the opposite approach, comparing autistic and non-autistic children to see if the autistic children had received more thimerosal-containing vaccines. No significant differences were found in the number of thimerosal-containing vaccines the two groups had received.

**Different forms of mercury exist.**

The mercury compound in thimerosal—ethylmercury—is chemically different from methylmercury, which is widely recognized as an environmental pollutant. Two key differences are that, unlike methylmercury, ethylmercury is (1) excreted from the body quickly, and (2) not easily transported across the blood-brain barrier (a structure of tightly packed cells that keeps potentially harmful substances in the bloodstream from entering the brain). The amount of ethylmercury in a thimerosal-preserved vaccine is minuscule compared with the amount of mercury that is required to cause symptoms of mercury poisoning. Also, the signs and symptoms of mercury poisoning are very different from the characteristics of autism. The chemical difference between

ethylmercury and methylmercury is similar to the difference between ethyl alcohol, found in wine and beer, and methyl alcohol (wood alcohol), a poison found in antifreeze.

As a precaution, by 2001, all routinely recommended childhood vaccines were changed to single-dose packaging so they wouldn't require thimerosal. At the time, this was thought prudent, but all the evidence that has emerged since then shows that there was never a danger of children being harmed by thimerosal in vaccines. In 2004, the CDC began recommending influenza vaccine for all children 6 to 23 months old; some influenza vaccine formulations come in multi-dose vials that are preserved with thimerosal. Today, influenza vaccine is the only childhood vaccine licensed for use in the U.S. that contains more than a trace of thimerosal, and we know that it is safe for children.

### **Studies have found no link between autism and MMR vaccine.**

Some studies of MMR vaccine compared groups of children who had received MMR vaccine against those who had not. These studies found that neither group was more likely to develop autism. Other studies looked at comparable groups of autistic and non-autistic children. These studies found that autistic children were no more likely to have received MMR vaccine.

Rumors about the safety of MMR vaccine first arose about a decade ago after a British physician (a gastroenterologist, not a person trained in either vaccinology or in neurological disorders) announced he had found virus from measles vaccines lingering in the intestines of 12 autistic children. He believed this accounted for their autism. Other researchers, however, were never able to replicate these results, which implied the gastroenterologist's conclusions were erroneous. Later, a press investigation revealed that the doctor had falsified patient data and relied on laboratory reports that he had been warned were incorrect. The journal that originally published his study took the unusual step of retracting it from the scientific literature on the grounds that it was the product of dishonest and irresponsible research, and British authorities revoked the doctor's license to practice medicine. The fear that vaccines might cause autism is a dangerous myth. Much scientific research has been devoted to this topic. The result has been an ever-increasing and uniformly reassuring body of evidence that childhood vaccination is, in fact, entirely unrelated to the development of autism. The readings below may be of interest to parents who wish to learn more.

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