

# VACCINES AND AUTISM

medical miracle  
or menace?

By Xin Guan



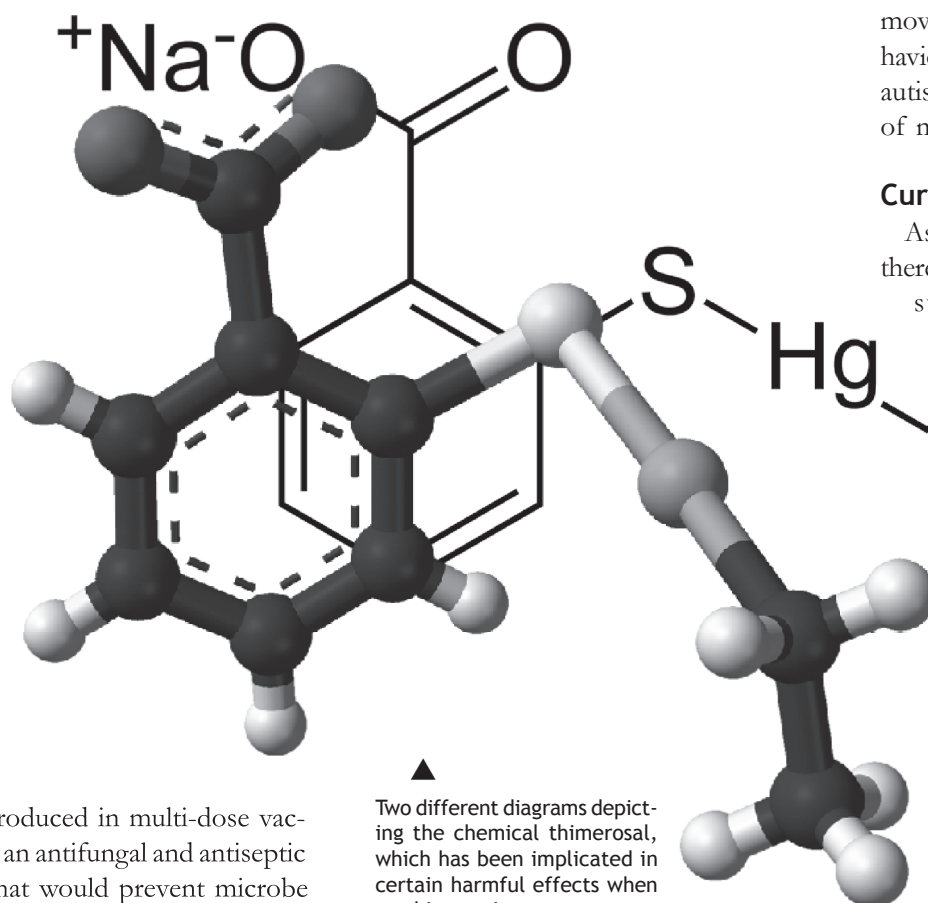
Since the late eighteenth century invention of the smallpox vaccine by Edward Jenner, the practice of vaccination has proven the most clinically-effective and cost-effective method of infectious disease prevention. Its significance is evident in the nature of today's public health policies where governments have instituted compulsory vaccination schedules aimed to reduce the risks of disease infectivity. As a result of these measures, everyone in the United States, Europe, and recently in many developing countries are required by law to receive a series of scheduled vaccines from early infancy until late secondary school years (1).

Nonetheless, an epidemiological trend that weakened the side-effect free claim of vaccines began to appear beginning in the late 1970s. The exponential hike in frequency of autistic symptoms parallels the rise in vaccine use during the late twentieth century. Many health officials, therefore, suggested that there might be a correlation between the rising distribution of vaccines and the occurrence of autism in young infants (2). Molecular

biologists soon pointed out thimerosal – a mercury-containing vaccine preservative -- as a possible causative agent of autism. This series of correlative data soon lead health experts to propose a connection between the use of vaccines and the onset of autism. However, results from multiple scientific studies have negated the hypothesis of vaccine-induced autism. Furthermore, reports and advising from the World Health Organization (WHO) and Centers for Disease Control (CDC) consistently assert a lack of causal relationship between the two (2, 3).

## Thimerosal and its role in vaccines

In 1928, a *Staphylococcus* infection incident killed over half of the patients inoculated with a diphtheria injection that lacked a preservative (5). Small-scale, yet consistent outbreaks of infections from preservative-lacking vaccines prompted pharmaceutical companies to develop a compound capable of inhibiting microbial propagation in a vaccine medium. Beginning in the late 1930s, a mercury-based preservative marketed by Eli Lilly and Company as thimerosal



Two different diagrams depicting the chemical thimerosal, which has been implicated in certain harmful effects when used in vaccines.

was introduced in multi-dose vaccines as an antifungal and antiseptic agent that would prevent microbe growth in stored vaccines (4). Its effects were immediate: the adverse and often lethal effects of bacterial infection from vaccine injections were almost eliminated. Additionally, the chemical properties of thimerosal were unique in that it did not reduce the biological potency of the vaccine.

Concerns appeared when studies characterized the effects of thimerosal in pure form. When inhaled or ingested, thimerosal produces symptoms physiologically similar to those of human poisoning targeting the central nervous system. When thimerosal degrades in the body, it becomes ethylmercury, a chemical that clears from the blood and brain with a half-life of 18 and 14 days, respectively (5). Importantly, the reports published in the 1990s documenting the adverse effects of pure thimerosal degradation were made on methylmercury, which is cleared from the blood and brain at a significantly slower rate than ethylmercury. Despite this obvious deficiency in the study, the data from these reports is still used, pro-

ducing “overly conservative” risk assessment guides for vaccine safety due to ethical concerns (5).

### Thimerosal and the Epidemiology of Autism

Autism is a neurological spectrum-disorder targeting infants before age three. Many children afflicted with this disorder fail to establish friendships with children the same age, possess lack of interest in sharing, and have difficulty understanding other people’s emotions. Autism can also delay an individual’s speech capability: as many as 40% of people with autism never speak (10). Although autism possesses a strong genetic basis, environmental causes have also been proposed, such as childhood vaccines. This began when parents started reporting symptoms of autism in their children around the same time as child’s routine childhood vaccination. In addition, there were strikingly similar observations regarding

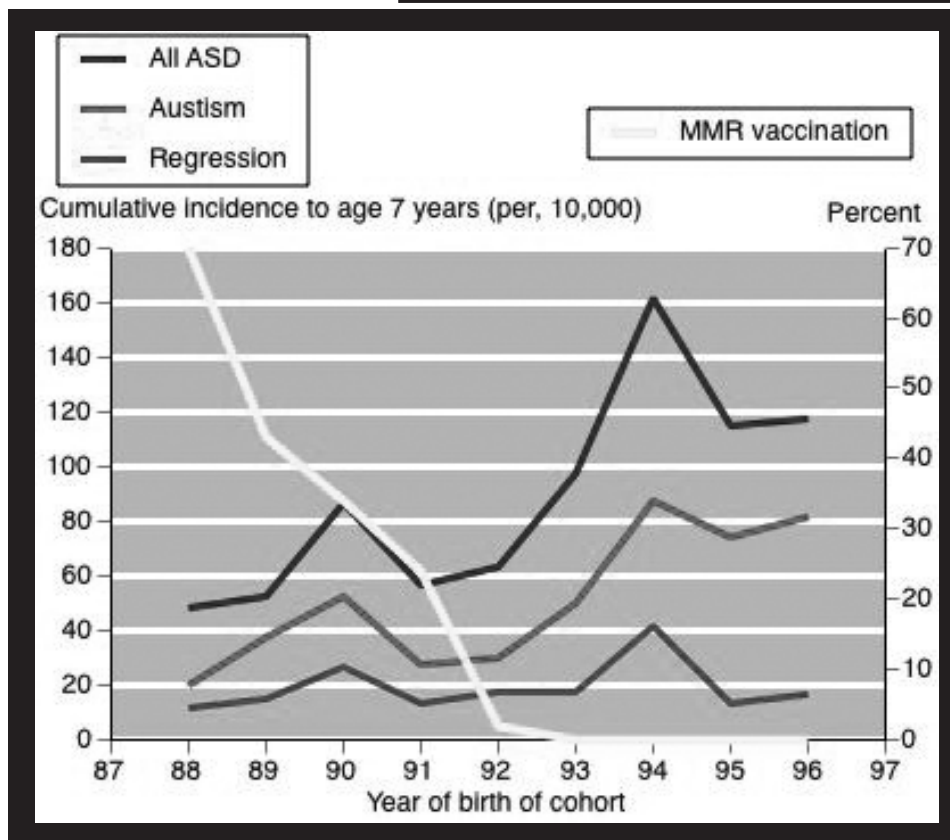
movement, physical characteristics, behavior, and visual coordination between autistic symptoms and the after-effects of mercury poisoning (6).

### Current Controversy

As reported by the WHO and CDC, there is severe lack of scientific evidence supporting a causative role of mercury-based vaccine additives in autistic development (2, 3). This conclusion is supported by the preponderance of technical literature published in prestigious journals (7). For example, a study established that the risk of autism and other autistic-spectrum disorders does not differ significantly between children vaccinated with thimerosal-containing vaccines and children vaccinated with thimerosal-free vaccines. In addition, there was no evidence of dose-response association for autism and for

other autistic-spectrum disorders (9). Multiple studies have reported similar results (7, 8, 9). A recent study analyzed the epidemiological statistics of a Canadian population to examine the relationship between thimerosal and autism. Between the years 1987 and 1998, immunization schedules in Canada changed due to the thimerosal issue, and as a result, the experimenters were presented with a unique opportunity to determine whether a direct relationship existed. The authors found that the greatest incidences of autism occurred in the late 1990s, past the date in which thimerosal was removed in Canada (11).

Despite the lack of causal evidence, thimerosal was removed from most childhood vaccines in 1999 to ensure ethically risk-free public health policy. As stated by the National Academy of Sciences, “the effort to remove thimerosal from vaccines was a prudent measure in support of the public health goal to reduce the mercury exposure of



The graph charts incidence of autism with usage of the MMR vaccination.

vaccines—and when these parents resist the vaccination of their children, they increase tremendously risk of the harmful diseases the vaccines are designed to prevent. Public fear of vaccines, however, has compelled decision-makers to remove thimerosal from vaccines, even if it financial unfavorable, without even the assurance that such measures are scientifically dictated or even likely to succeed.

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infants and children as much as possible.” (5) Since that statement, many developed nations including the United States and Canada have limited the use of thimerosal in vaccines (2). Consequently, most pharmaceutical companies have limited production of live Measles, Mumps, and Rubella (MMR), oral and inactivated polio, yellow fever, and Bacillus Calmete-Guerin (BCG) vaccines exclusively to single-dose packages because this particular type of vaccine delivery does not require the use of a preservative during storage (2). However, the removal process has also resulted in administrative complications. As per regulation by the WHO, any alteration in ingredient composition of a licensed vaccine requires a new licensing process including a series of preclinical and clinical trials to ensure that the new vaccine is safe and efficient according to regulation listings (3).

In addition to regulatory complications, costs involved in the single-dose manufacturing process are substantially higher than preservative-supplemented multi-dose packages (2, 3, 8). Moreover, some experts contend that it is

more ethical to distribute sufficient amounts of preservative-containing vaccines to developing countries as opposed to investing capital that ensures the production of less single-dose vials especially given the lack of causative evidence (8). In promoting the use of more expensive single-dose vaccines, governmental agencies are instead needlessly increasing the risk of infection of children in developing countries who do not have access to vaccines.

### Prospects for the Future

The devastating effects effect of autism and the undisputed increase in its incidence present an unquestionably grave issue to the public health community. Despite the claims supporting a correlative association between vaccine use and autism, no causative connection has been established. If thimerosal causes autism, then its removal from scheduled immunizations should lead to a decrease in autism incidences, which epidemiological studies have not observed (3, 6, 7, 9, 11). Nonetheless, parents remain skeptical about

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