

# Mercury Rising

## Exposing the Vaccine-Autism Myth

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ON JUNE 11, 2007, NEARLY 5,000 PARENTS OF autistic children filed a lawsuit against the federal government, claiming that childhood vaccines (specifically the mercury-containing thimerosal in the vaccines) caused their children's autism. The previous year the *New York Times* ran a column that was skeptical of the alleged link between autism and vaccines. It generated the following comment on an Internet message board, typical of the anecdotal analyses that perpetuate the claim:

You say, "There is no proven link" between mercury and autism. There also is "no proven link" between going outside in the rain and cold without a hat or coat and getting the sniffles. Look at the data: the epidemic of autism mirrors the administration of vaccines with mercury. Now that they are off the shelves (more or less), the cases are going down.

Here we see how the writer dismisses scientific evidence that fails to support a link between cold and illness and vaccines and autism in favor of her personal experiences. And the vaccine-autism controversy is not constrained to a small fringe group of parents or advocates. Increasingly, people of position and power are leaping into the fray, spurred on by vocal groups demanding action. For example, an article by Robert F. Kennedy, Jr. appeared in a June 2005 issue of *Rolling Stone* magazine<sup>1</sup> that alleged thimerosal-containing vaccines were at the heart of the autism epidemic and, moreover, that the government was aware of this and actively engaged in a cover-up.

This article makes five points concerning the relation between thimerosal-containing vaccines and autism: (1) the dangers of mercury are well established, but this does not lead inexorably to a relationship between vaccines containing

thimerosal and autism; (2) a number of well controlled studies have failed to uncover any correlation between the delivery of the vaccines and the onset of autism; (3) even if some correlation existed there are a number of alternative explanations for the correlation that do not assume any causal relationship between the vaccine and autism; (4) much attention has been given to a possible government cover up, which is certainly of concern if true but is otherwise independent of the problems with claims of a link between thimerosal and autism; and (5) the type of public hysteria manifested in the current controversy is not new and we would be well served to learn from similar controversies of recent times.

### Mercury, Thimerosal, and the Potential for Harm

Science has told us unequivocally that mercury is bad for our bodies. In sufficient doses, mercury kills cells that it contacts, causes neurological damage in humans and other animals, and generally wreaks havoc on living things. Yet since the 1930s, thimerosal has been used as a preservative in vaccines.<sup>2</sup> One of the breakdown products of thimerosal is ethylmercury, which is an organic compound of mercury. Public concern about thimerosal is certainly understandable, but does this mean that concern about a link between vaccines and autism is justified as well? In a word, no. Mercury might do a number of nasty things to the human body, and concern about it is therefore justified, but that does not mean it causes autism.

Ethylmercury is not the same thing as its cousin, methylmercury. Cumulative and high doses of methylmercury can produce renal and neurologic damage. It can build up in the brain and stay in the body for a long time. Ethylmercury is more, well, mercurial. It is

expelled rapidly from the body and it does not accumulate. Nevertheless, guidelines for the ingestion of ethylmercury were based on those for methylmercury. Around the same time these guidelines were formalized, children were receiving more vaccines that contained thimerosal. For example, in the early 1990s the *Haemophilus influenzae b* and hepatitis B became staple features of the vaccine schedule for infants, which already included another thimerosal-containing vaccine (diphtheria tetanus and variants). Based on the very conservative guidelines established by the Environmental Protection Agency (EPA), it was concluded that by age two some children might be receiving excessive levels of ethylmercury when considered in the context of known risks of methylmercury exposure.<sup>3</sup>

Against this backdrop enter skyrocketing rates of autism diagnoses. In California, the Department of Developmental Services reported a 273% increase from 1987 to 1998 in the number of individuals served under the category of autism.<sup>4</sup> Surely this increase in rates was caused by an environmental source, right? In 2001, the Institute of Medicine (IOM) Immunization Safety Review Committee held a public meeting to address the link between one environmental source—thimerosal—and autism. At the meeting, Mark Blaxill, a board member of a nonprofit organization dedicated to investigating the risks of mercury exposure, presented a graph showing the *estimated* cumulative dose of thimerosal to the *estimated* prevalence of autism in California.<sup>5</sup> The increasing trend lines during the early 1990s were right on top of each other, about as close as you can get to perfect correlation in ecological data. Such orderly correlations are all that it takes to convince the uncritical eye.

Even before the IOM meeting, thimerosal was removed as a preservative in vaccines

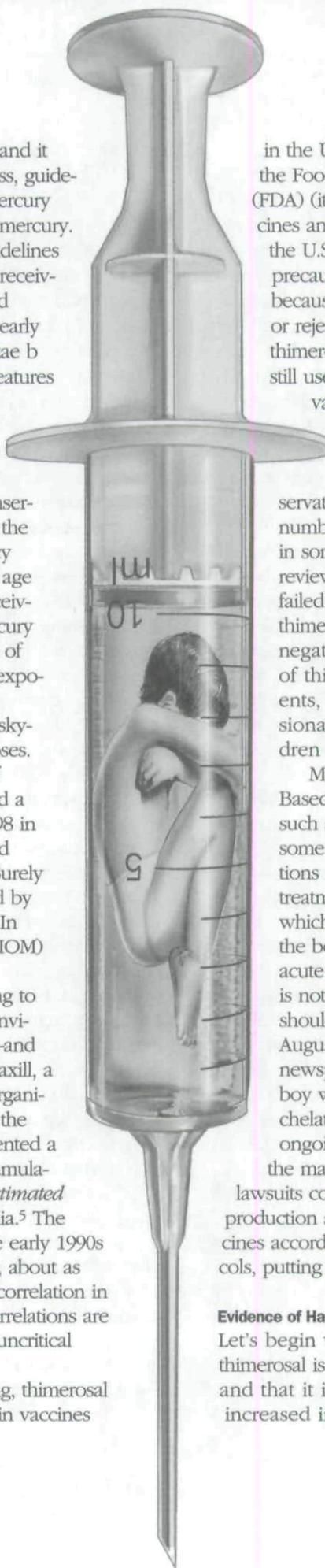
in the U.S., based on a request from the Food and Drug Administration (FDA) (it remains in some influenza vaccines and in some vaccines outside of the U.S.). The request was made as a precautionary measure, and not because there was evidence to accept or reject a causal relationship between thimerosal and autism. (Thimerosal is still used during manufacture of some vaccines to ensure sterility, but the trace amounts remaining are 50 times lower than when thimerosal is used as a preservative.) Since the FDA decision, a number of research reports published in some of the most esteemed peer-reviewed journals in the world have failed to find any relation between thimerosal and autism. Despite these negative findings and the removal of thimerosal from vaccines, parents, politicians and health professionals remain alarmed that children are at risk.

Much is at stake in this debate. Based on the assumption that metals such as mercury are causing autism, some parents are avoiding vaccinations altogether. Others have sought treatments like chelation therapy, which uses special chemicals to rid the body of heavy metals following acute poisoning. However, chelation is not a risk-free procedure and should not be undertaken lightly. In August of 2005, a Pittsburgh, PA area newspaper reported that a 5-year old boy with autism died following chelation therapy. Finally, there are ongoing class action lawsuits against the manufacturers of vaccines. These

lawsuits could potentially endanger the production and distribution of effective vaccines according to well-established protocols, putting scores of young children at risk.

#### Evidence of Harm

Let's begin with the hypothesis that thimerosal is one of the causes of autism and that it is the main culprit in the increased incidence of autism during the



1990s. This is a plausible hypothesis, but as Karl Popper taught us, a good scientific hypothesis must be falsifiable. That is, it must be possible to conceive of evidence that would prove it wrong. What evidence might suggest that the thimerosal hypothesis is false? For obvious ethical reasons, we can't perform the kind of gold-standard experiment—a randomized double-blind study—which would most convincingly indicate the lack of a causal relation. We must rely on natural experiments. One such experiment was occasioned by the removal of thimerosal in Denmark in 1992. If the thimerosal hypothesis were false, we would not expect to see changes in the rates of autism following the removal of thimerosal. In fact, the results were more robust: despite the removal of thimerosal, the rates of autism continued to climb. And not only in Denmark but in Sweden, too, where thimerosal was removed at about the same time.<sup>6</sup>

Another way the thimerosal hypothesis could be falsified is if it could be shown that there is no link between the amount of thimerosal exposure and the likelihood of autism. That is, we would ask if there is a dose-response relation between thimerosal exposure and developmental problems. Several studies have confirmed that there is no convincing evidence of a dose-response relation.<sup>7</sup> In fact, one study suggested a beneficial effect of thimerosal! For example, exposure at three months was inversely related to problems of hyperactivity, conduct, and motor development months or years later.<sup>8</sup> Now, these results do not imply causation, nor do they pertain to autism *per se*, but they do question the general validity of the thimerosal hypothesis.

So what of the data favoring the thimerosal hypothesis? Indeed, we must consider all sources of evidence in evaluating the truth of a claim—we must be comprehensive. Recently, some researchers have suggested that the incidence rate of autism has been on the decline since thimerosal was officially removed from vaccines in the US. If true, this would be evidence of a possible causal relationship between thimerosal and autism, and such data has been reported by one team of researchers, Mark and David Geier. Unfortunately, the study that proposed such a relationship used the Vaccine Adverse Event Reporting System (VAERS) database to make the claim.<sup>9</sup> The VAERS is a passive reporting system that is subject to reporting biases and errors. A

health-care professional, parent, or even someone trying to prove a point<sup>10</sup> can enter data into the VAERS. There is no way to verify diagnoses, identify mistakes in filing, or substantiate causal hypotheses.

The irreparably flawed studies by the Geiers prompted a strong rebuke from the Centers for Disease Control (CDC) and by the American Academy of Pediatrics.<sup>11</sup> Simply put, the VAERS data may be useful to raise some potential questions about a phenomenon, but it certainly cannot be used to prove a hypothesis. Studies that use methods consistent with well-established scientific standards have failed to find any association between thimerosal and autism. In 2004, the Institute of Medicine concluded, "Given the lack of direct evidence for a biological mechanism and the fact that all well-designed epidemiological studies provide evidence of no association between thimerosal and autism, the committee recommends that cost-benefit assessments regarding the use of thimerosal-containing versus thimerosal-free vaccines and other biological or pharmaceutical products, whether in the United States or other countries, should not include autism as a potential risk."<sup>12</sup>

But what if it were determined that a strong correlation existed between the administration of thimerosal-containing vaccines and the onset of autism? Much would still be left unanswered. Consider that the average age for many vaccinations is between 12 and 18 months. Now consider that many of the "symptoms" of autism—such as social withdrawal and delayed language—aren't readily detectable until this same age or just a bit later. It could very well be that any relationship between vaccination and diagnosis is purely coincidental. If these vaccinations were not commonly given until age four, perhaps no correlation would be observed. Not to mention that the vast majority of children receive these vaccinations without incident.<sup>13</sup>

The bottom line is that *correlation is not causation*.

#### **Autism Epidemic or Statistical Artifact?**

Another problem for the purported vaccine-autism link is that there is good reason to be suspicious of claims of an autism epidemic. A number of factors can account for the dramatic increase in numbers, including the expansion of diagnostic criteria in 1994, and changes in criteria

for inclusion in child-count data for children with autism. Remember that 273% increase over a decade in autism spectrum disorders in California? Consider, as did the authors of a recent paper published in *Current Directions in Psychological Science*,<sup>14</sup> that this increase could be due to an expanded diagnostic definition of autism. The authors found that a similar expansion in the definition of "tall"—from 74.5 inches to 72 inches—generated a 273% increase if these two criteria were applied a decade apart in one county in Texas.

More important, autism is not even a "thing" that can be clearly correlated with any other thing. Unlike cancer or a broken bone, there are no discrete physical, biological, or genetic markers on which to base a diagnosis. Instead, autism is a diagnostic label based on the presence of a number of behavioral excesses and deficits. The diagnosis is subjective and subject to great variability. When you consider that many resources are made available only to those children with some formal diagnosis, it is easy to see why some diagnoses might be made with scant supporting evidence. The physician or psychologist notices some obvious learning delays and behavior problems in a patient and recognizes the need for intensive services, but the only way the family can obtain those services is if the child fits a certain diagnostic category.

Correlations are tenuous things under the best conditions. Degrade one of the variables, and you are in serious trouble. Such is the case with the autism-vaccine correlation.

#### **A Vast Government Conspiracy?**

So what do vaccine opponents make of the evidence against the vaccine-autism hypothesis? Mostly, they assert a vast conspiracy propagated by government and industry. It is proposed that government agencies such as the Centers for Disease Control and Prevention, in conjunction with scientists with varying ties to the pharmaceutical industry, have gone to great lengths to suppress evidence supporting a link between vaccines and autism. Indeed, this was the main point of Robert Kennedy Jr.'s *Rolling Stone* article. He and others claim that a conspiracy does exist and was formally discussed at a top-secret meeting in Simpsonwood, GA in 2000.

One hotly discussed result of this meeting is the purported doctoring of data by Thomas

Verstraeten who, according to the vaccine opponents, presented data supporting the autism-vaccine link but later altered the data to support the opposite conclusion because he was, by then, employed by a large pharmaceutical company. Verstraeten has denied such manipulation and the data he reports support the conclusions reached by a number of other independent researchers.<sup>15</sup> The problem is that the only evidence of doctored data sets, dubious activity at the Simpsonwood meeting, and assorted cover-ups seems to come from a small number of zealous vaccine opponents who can offer no corroborating evidence to support the hearsay.

Now let us return to the research team purporting to have data supporting the autism-vaccine hypothesis. In addition to the flawed methods on which their conclusions are based, there are conflicts of interest that should cause one to question their motives. As it turns out, David Geier is the president of MedCon, Inc., a legal firm that seeks compensation for people claiming to have been harmed by vaccines. He also has filed, with his father Mark Geier, two patents related to a treatment for autism involving a combination of drugs and chelation. Chelation therapy is, of course, predicated on the assumption of excessive amounts of heavy metals in the blood stream of children with autism. The Geiers are clearly in a position to benefit if claims concerning a vaccine-autism link are accepted by the public.

#### **History Repeating**

A revealing aspect of this controversy is how closely it resembles past controversies, pitting science against vaccine-induced autism claims, spurred on by desperate parents, media support, and various servants of the public interest. Not so long ago, science was up against a similar set of public crusaders pushing a different cause: carcinogenic power lines. In 1979, a small, poorly controlled and poorly conducted sampling of leukemia patients in Denver, CO supposedly revealed a correlation between the patients and the proximity of their homes to high-power lines.<sup>16</sup> The published report of these suspect findings was largely ignored by the scientific community because of the many fatal flaws evident in the methodology. Enter Paul Brodeur, a journalist with a track record of sensationalism (in the 1960s he wrote *The Zapping of America*, a book "exposing the dangers" of microwave ovens),

now warned the world of the dangers posed by power lines in his book *Currents of Death*.

No amount of scientific evidence to the contrary could persuade the journalists, advocacy groups, and legal teams demanding accountability. Of course, the million-dollar question was, "Accountability for what?" Ultimately, after numerous well-controlled studies failed to find any correlation between power-lines and cancer, the story grew cold and the public outrage slowly faded away. But not before tens of millions of dollars in research funding, decreased property values, and lawsuits were lost because the matter was pursued long after science had delivered a verdict. Are we doomed to repeat this history with the vaccine controversy?

#### Clarifying Claims

Claims of a causal link between the administration of thimerosal-containing vaccines and the onset of autism are unfounded. The controversy has been driven more by public fervor than it has by science. This is not to suggest that the advocates and parents fueling the fire are malicious or intentionally misleading the public. The reality is that too many families face the unimaginable hardship of learning that their child has been diagnosed with autism and must encounter the subsequent trials and tribulations of providing the best possible care and education for their child. These parents are in desperate need of both assistance and answers. Compounding the difficulty is that many must navigate the waters of emerging science without having received the necessary training to do so. Clarifying misguided claims of causative factors can help redirect necessary resources to more promising treatments, and perhaps reveal a better understanding of the real factors that cause autism. ▼

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- Such a system cannot be used to prove a hypothesis. Consider that Dr. James Laidler allegedly reported that the influenza virus turned him into the Incredible Hulk, and the VAERS system accepted his report! Dr. Laidler reports that a representative of the CDC did contact him after noticing the report and, ultimately, it was deleted from the VAERS system, but only because Dr. Laidler granted permission. According to Laidler, had his permission not been granted, the report would have remained in the VAERS system. Others have reported submitting spurious reports to the VAERS system—for example that a vaccine turned someone into Wonder Woman—with similar success.
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- Of course, this does not exclude the possibility that thimerosal might differentially affect an especially sensitive subset of children. Recently, researchers have reported that the neurotoxic effects of thimerosal exposure are related to autoimmune disease-sensitivity in mice. It is unclear whether these results will hold true for humans and whether such neurotoxicity has any relationship to autism, but it is an important area for further research. Unfortunately, because the "differential sensitivity" hypothesis is not yet well researched, there is no way to identify and protect those that might be at risk if it proves true. However, we know without question the dangers of disease and risks of avoiding vaccination. No matter the suspicions, the most prudent course of action is to go the vaccine route until there is real evidence to do otherwise. Also, we should note that existing evidence already casts doubt on the differential sensitivity hypothesis. If the rates of sensitivity to thimerosal remained constant before and after thimerosal was removed from vaccines, we would still expect a decrease in rates of autism. As reviewed above, this was not the case.
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