

## **Autism: Tornado in the Brain**

By William J. Walsh, PhD and Dan E. Burns

"It's becoming quite clear to more and more of us that autism is not genetic, but epigenetic." So says William J. Walsh, who received a Ph.D. in chemical engineering from Iowa State University and is an expert in nutritional medicine. In the 1970s, he collaborated with the renowned Dr. Carl Pfeiffer, a pioneer in schizophrenia research, and went on to develop nutrient protocols to normalize brain chemistry in patients with behavioral and personality disorders, schizophrenia, and autism. Walsh's new book, *Nutrient Power*, is subtitled *Heal Your Biochemistry and Heal Your Brain*.

I asked Bill what has happened in autism research since the late 1980s when he became associated with Dr. Rimland, founder of the Autism Research Institute. Here's what he told me.

BILL: "When I first connected with Bernie, a wonderful inspiring man, he realized that I'd seen more autistic patients than anybody in the world, eventually six thousand five hundred. More importantly, I had the world's biggest chemistry database for autism. I'd already organized a prison volunteer program to study the biology of prisoners and ex-offenders, researching the causes of their violent behavior. And the first thing Bernie and I realized was that autistic children – ASD spectrum kids – have far more severe chemistry, lab results farther outside the normal range, than criminals.

"Bernie asked me to come to some of his think tanks and give information. No one was surprised when I reported that ASD kids had B6 deficiency and elevated toxic metals, especially mercury, cadmium, and lead, plus high copper and low zinc. The surprise was that more than 95% of kids who had autism were undermethylated. Following that think tank, Jon Pangborn launched a study of how disruptions in the methylation cycle are consistent with ASD symptoms. Eminent methylation scientists Jill James and Richard Deth took up the challenge. We now know that undermethylation is a distinctive feature of ASD."

*Dan: Why did you develop the Epigenetic Theory?*

BILL: "In the history of science, progress has often been hastened by the development of theories that attempt to explain the mechanisms of poorly understood phenomena. Then, over time, as new information comes in, the model can be honed and improved. We needed a new theory to account for the effect of environmental toxins on gene expression. That's why I developed the epigenetic

theory of autism.”

*DAN: What’s the difference between genetics and epigenetics? My understanding is that genetic theories of autism have not been very helpful to date.*

BILL: “That’s right. Genetic therapies – trying to change DNA that’s gone awry in kids, with Down Syndrome, for example – have been a washout. They haven’t led to much of anything. But the early research on altering epigenetic deviations has been really promising. And I think that’s the hope for the future.”

*DAN: So what is epigenetics?*

“Epigenetics is the natural process of gene regulation that is established in the early days of gestation in the womb. A severe environmental insult later in life can either turn off a necessary gene or turn on a damaging gene, resulting in a disorder that can persist for years.

“We know that autism runs in families but violates classical laws of genetics. We know that in identical twins, if one of them develops autism, it’s more than sixty percent likely that the other will too. However, it’s not a hundred percent; so it’s not the DNA, not the genome. That means that environmental insults must be involved.”

*DAN: How can environmental insults lead to autism without altering the genome?*

BILL: “A gene has only one job, and that’s to make a protein. We have identical DNA and identical genes – the same cookbook – in every cell of our body, but every tissue in our body needs a different combination of proteins. How to make that happen? Methyl groups, which are basically groups of carbon atoms with some hydrogen attached, act like bookmarks. They tell our metabolism where to start reading the cookbook and where to stop. Methyl groups attach to certain parts of DNA to regulate whether a gene is turned on or turned off. So they program the DNA and determine which proteins are expressed in each tissue.”

*DAN: It reminds me of an old-fashioned player piano. The piano is your DNA, and the scroll is your epigenome. The holes in the scroll determine which string is played or “expressed,” so you can play “Johnny B. Goode” or a Bach cantata by changing the scrolls.*

BILL: “Yes. You can program the tune – the cell – without changing the DNA.”

*DAN: But how does this epigenetic theory explain that children who appear to be normal at birth but regress in their second year? Have you seen that happen?*

BILL: “I’ve seen probably five thousand children who had a normal beginning in life, and around age 18 to 24 months had the very nasty sudden regression when autism onset came. I believe that altered epigenetics in the womb causes

weakened protection against oxidative stress. And it's pretty clear that somewhere between conception and age three, there was an environmental insult that just overwhelmed their anti-oxidant protectors and shuffled the epigenetic bookmarks, resulting in deviant gene expression. The trigger may be prenatal, postnatal, or cumulative (both). Here's my epigenetic model in a nutshell:

1. Undermethylation in the womb causes overexpression of several genes, weakened protection against oxidative stress, and increased vulnerability to environmental insults.
2. Environmental insults, which can include mercury, lead, cadmium, viruses, or other sources, reach a tipping point and overwhelm natural antioxidant protectors, reshuffling epigenetic bookmarks and altering gene expression.
3. Altered gene expression results in abnormal brain development, a tendency for serious brain inflammation, and physical problems including weakened immunity, sensitivity to toxins and certain foods, tendency to seizures, and poor behavior control. The Epigenetic Model of Autism is explained in more detail on pages 110-111 of my book *Nutrient Power*."

*DAN: In your AutismOne presentation, you said that mercury does its damage in 30 seconds. That would make it like a tornado, sweeping in and out of Moore, Oklahoma, and leaving devastation behind. Am I remembering that right? Please explain.*

BILL: "When mercury enters the brain, it quickly undergoes chemical reaction with substances in the brain. A large amount of mercury can cause great damage, especially in the developing brain of a young child. This is a leading suspect in the onset of regressive autism. However, in most humans, the half-life of mercury in the brain is about 70 days, and the reacted mercury may have become inert before departing the scene. Experimental evidence indicates that mercury levels in brains of the older autistic children we looked at, ages 5-11, were not seriously high. A mercury insult may well have triggered autism in many children, but it appears this early mercury has left the body and cannot cause continuing harm. The problem is that epigenetic changes survive cell division, so the autism conditions can persist a lifetime, even after the mercury is gone. After a tornado, there may be great destruction but the problem is no longer the tornado but the damage that it caused. The same may be true for environmental insults like mercury."

*DAN: Shouldn't our children get better? Aren't old, damaged brain cells replaced, eventually, by new ones, as mercury leaves the brain?*

BILL: "You're asking about the greatest mystery of autism – Why in stubborn cases doesn't it go away after onset, despite the multitude of aggressive treatments that have been tried? The answer appears to be epigenetics - an

environmental insult has altered gene regulation and set up misleading detour signs along the developmental pathways. The good news is that biochemical therapies and other interventions can either (a) adjust gene expression or (b) overcome the effect of altered gene expression. For example an epigenetic tendency for high oxidative stress can be effectively treated using antioxidant supplements.

“Unfortunately, autism is a developmental disorder and as the child matures, the effects of altered gene expression are cast in physiology. Autism brains are structurally different from neurotypical brains. The differences include narrowed minicolumns in the brain’s cortex, altered connectivity between different brain areas, a reduced number of synapses, and certain brain areas that have never completed the maturation process. It’s conceivable that the developmental detour signs could someday be removed. But fixing the autism brain requires a lot more than replacing damaged brain cells. Fortunately, the brain is very plastic and brain-directed therapies have great promise.”

*DAN: Can epigenetic variations be passed on?*

BILL: “Yes, and that was something that was a surprise. Because we’ve known that when conception begins, the epigenetic markers from the mother and the father are supposed to be erased, and you get a new start. But now there’s clear evidence that there’s something called ‘Transgenerational Epigenetic Inheritance’ or TEI transference. If a father has an exposure to mercury, and that mercury changes his gene expression, which can happen, the next two generations of children are likely to have the same problem. In other words, epigenetics can pass from father to son. I like to use a quote from Deuteronomy: ‘The sins of the father will be visited upon the son.’”

*DAN: What about the mother?*

BILL: “The mothers are even more important if you look at the things that can cause epigenetic errors. One of them is an insufficient level of folates or folic acid in a pregnant woman. Another would be toxic metals such as mercury, lead or cadmium. We know that they can cause epigenetic errors. Under-methylation in the womb is a major factor in brain development and epigenetic errors. And those errors are heritable.”

*DAN: Since lead has been removed from gasoline and from paint, and since mercury has been mostly phased out of mandated childhood vaccines (but not flu shots) beginning in the year 2000, shouldn’t autism rates be going down, not up? Why doesn’t the incidence of autism decline?*

BILL: “Starting in 2005, about the time we would expect a dramatic decrease in autism incidence because of the phase-out, my colleagues and I noticed a huge increase in patients diagnosed with autism whose biochemical profiles did not

match our typical chemical profile of ASD kids. Were they misdiagnosed? By the standards we were using, yes. We had to exclude them from the research studies. Clearly something new was going on here. However, we continued to see large numbers of children with severe autism throughout the period. Like many others, I was disappointed to learn that the removal of mercury from USA childhood vaccines failed to result in a dramatic decline in autism incidence.”

*DAN: So what is driving the epidemic now?*

BILL: “There are three points to keep in mind.

“First, as Dan Olmsted points out, the increased uptake of mercury-containing prenatal flu shots given to pregnant women appears to layer in just as the other mercury-containing shots were phasing out. Many epigenetic deviations occur around day 20, before most women know they’re pregnant. I think that’s a very serious issue.

“Second, altered epigenetics due to undermethylation persists across generations, and most great athletes, doctors, lawyers, and CEOs are undermethylated. Put undermethylated men and women together, which is inevitable in our increasingly stratified society, and that’s probably another reason why the epidemic persists.

“Third, toxic metals and viruses are not the only risk factors. Dozens of other genotoxins could potentially trigger autism in a predisposed child. Kathy Blanco has listed at least twenty-five. Many of these have not been explored in depth. We need to keep an open mind and not let what we know blind us to what we don’t know. Emotion is the enemy of science and logical thought.”

*DAN: Where does your epigenetic theory of autism lead us? What is your vision of the future?*

BILL: “Not too far in the future autism can be prevented. In some unknown year, at some future time, newborn babies will be tested for not just their genetics, but their epigenetics, to determine what genes are turned on and off properly or improperly. I think there will be therapies to fix that early on, based on recent advances in reversing deviant epigenetic bookmarks in cancer. Epigenetic therapies will probably be the most effective therapies in the future for children. These therapies don’t really exist yet, but they’re coming.”

*Dan E. Burns, Ph.D., is the father of a 25-year-old son on the autism spectrum and the author of Saving Ben: A Father’s Story of Autism. Through his new dba, Appleseed Ventures, Dan empowers parents to organize communities where their adult ASD children and friends can live, work, play, and heal.*

*William J. Walsh, Ph.D., is an internationally recognized expert in the field of nutritional medicine. He is president of the non-profit Walsh Research Institute in Illinois and conducts physician-training programs in advanced*

*biochemical/nutrient therapies in the U.S., Australia, Norway and other countries. His book, Nutrient Power (Skyhorse Publishing), which describes an evidence-based nutrient therapy system, was recently published. He has authored numerous peer-reviewed journal articles and scientific reports, as well as been granted five patents. He has presented his experimental research at the American Psychiatric Association, the U.S. Senate, and the National Institutes of Mental Health. After earning degrees from Notre Dame and the University of Michigan, Dr. Walsh received a Ph.D. in chemical engineering from Iowa State University. While working at Argonne National Laboratory in the 1970s, Dr. Walsh organized a prison volunteer program that led to studies of prisoners and ex-offenders researching the causes of their violent behavior. A collaboration with Carl C. Pfeiffer, M.D., Ph.D., a pioneer in the field of nutritional research therapy, led Dr. Walsh to the development of individualized nutrient protocols to normalize body chemistry and brain chemistry. Over the next 30 years, Dr. Walsh developed biochemical treatments for patients with behavioral disorders, attention deficit hyperactivity disorder, autism, depression, anxiety disorders, schizophrenia and Alzheimer's disease that are used by doctors throughout the world. Dr. Walsh has studied more than 25,000 patients with mental disorders. His accomplishments include (a) groundbreaking studies reporting reduced violent behavior following nutrient therapy, (b) the 1999 discovery of undermethylation and copper/zinc imbalances in autism, (c) the 2000 finding of metallothionein protein depletion in autism, (d) the 2007 published study linking copper overload and post-partum depression, (e) the identification of five biochemical subtypes of clinical depression, (f) the 2011 development of the Walsh Theory of Schizophrenia, and (g) the direction of the Beethoven Research Project that revealed that the composer suffered from severe lead poisoning. Dr. Walsh has conducted chemical analysis of more than 25 serial killers and mass murderers, including Charles Manson, Richard Speck, James Oliver Huberty, Patrick Sherrill and Arthur Shawcross. He has assisted medical examiners, coroners, Scotland Yard, and the FBI in these forensics studies. He has designed nutritional programs for Olympic athletes, NBA players, major league baseball players, a heavyweight boxing champion, PGA and LPGA golfers, and others. Walsh Research Institute's current research includes studies of autism brain tissues, the role of epigenetics in mental health, oxidative stress in disease conditions, and underlying causes of bipolar disorder.*