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Hallmarks of Alzheimer's Are Stimulated by This Substance

Analysis by Dr. Joseph Mercola ✔ Fact Checked | June 25, 2023

STORY AT-A-GLANCE

- Using nucleotide photoaffinity labeling technology, Boyd Haley, Ph.D., showed that mercury is the only heavy metal capable of causing a normal brain to develop the same biochemical abnormalities found in Alzheimer's disease
- The enzyme creatine kinase is 98% inhibited in Alzheimer's patients, and tubulin is inhibited by more than 80%
- Mercury causes the synaptic clefts to disappear and triggers the formation of neurofibrillary tangles, a major diagnostic hallmark of Alzheimer's, by causing abnormal hyperphosphorylation of tau
- The chelating compound Haley developed, called emeramide or NBMI, tightly binds to mercury and expels it through your stool
- Phase I and Phase II drug trials has shown emeramide significantly lowers mercury burden in animals and humans; the drug is still going through the approval process; it is designated as an orphan drug for use as a mercury chelator in both the U.S. and the European Union

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Boyd Haley, Ph.D., is a chemist specializing in the development of chemicals to chelate toxic metals, both from the environment and the human body. I had the opportunity to interview Haley (above) at the 2018 Academy of Comprehensive Integrative Medicine (ACIM) conference in Orlando.

Haley's Ph.D. is in chemistry and biochemistry. He conducted research funded by the National Institutes of Health (NIH) for 25 years at the University of Wyoming and at the University of Kentucky. Early in his career, he developed a biochemical detection system called nucleotide photoaffinity labeling and has published studies on its usage.[1] Haley explains:

> *"I took ATP and made it radioactive, which isn't a big feat. But then I attached to that a molecule that would explode when it hit a photon of light. When it exploded, it made a very reactive intermediate that had a half-life of something like 10-12 or 10-13 seconds.*
>
> *If ATP was bound to a protein, such as sodium potassium ATP [and] … you hit it with light, it would form a covalent bond at the binding site of ATP on the enzyme it was interacting with …*
>
> *You could use these kinds of probes to see the difference between the ATP, guanosine diphosphate (GDP), cyclic adenosine monophosphate (AMP) and nicotinamide adenine dinucleotide (NADH) — all these binding proteins, to see how the energetics of the cell was changing."*

Haley's Alzheimer's Research

He later took a position with the Alzheimer's Center, a research center for Alzheimer's disease, where he collaborated with a former graduate student of his. The NIH funded their research for five years, which used Haley's technology to assess the differences of ATP, GDP and cyclic AMP binding proteins in normal brains versus those with Alzheimer's disease.

"There were dramatic differences," he says. For example, the enzyme creatine kinase, which is a fundamental enzyme, is 98% inhibited in Alzheimer's patients. They also discovered that tubulin — a major brain protein that holds an axon in its extended form and controls the growth direction of axons and dendrites — is inhibited by more than 80%.

In 1989, he published the paper[2] "Aberrant Guanosine Triphosphate-Beta-Tubulin interaction in Alzheimer's disease" in the Annals of Neurology, stating that "These results support the hypothesis that microtubule formation is abnormal in brains affected by Alzheimer's disease."

Haley goes on to recount the story of how he got into trouble with the NIH when he decided to investigate the influence of heavy metals on Alzheimer's susceptibility. A popular theory at the time was that Alzheimer's was caused by aluminum toxicity.

Using his technology, he was able to show that mercury was the only heavy metal capable of causing a normal brain to develop the same biochemical abnormalities — including abnormal tubulin — that you find in Alzheimer's disease.

Haley claims his research has since been replicated and confirmed. According to Haley, mercury causes the synaptic clefts to disappear and triggers the formation of neurofibrillary tangles, a major diagnostic hallmark of Alzheimer's, by causing abnormal hyperphosphorylation of tau.

He also published a paper[3] in the respected medical journal Proceedings of the National Academy of Sciences in 1992, detailing how the presence of glutamine synthetase in the cerebrospinal fluid may be a potential diagnostic biochemical marker of Alzheimer's disease, as well as more than 100 other studies,[4] including a review of the relationship between mercury and autism,[5] and research showing how the chelating agent he developed, emeramide (NBMI), protects against the cytotoxicity of mercury.[6]

Biochemical Abnormalities Are Stimulated by Mercury

Beta-amyloid, which many associate with Alzheimer's, is not the actual cause of the disease. It's just a marker; it's a result of the disease. However, you can cause beta-amyloid buildup in the brain by treating neurons with mercury.

> *"What happens is mercury inhibits the expression of neprilysin, which is the main protease in the brain used to chew up beta-amyloid. Mercury doesn't*

affect beta-amyloid, but what it does do is it keeps the protease, the cleanup enzyme, from being expressed," he explains.

"If you give mercury at low levels, very low levels, to tissues that are going to live for a while, you'll see a buildup of beta-amyloid protein. The bottom line is: 6 out of 6 of the major biochemical abnormalities and pathological hallmarks of Alzheimer's disease can be stimulated by adding mercury.

I can tell you that was something that NIH, or the people who run NIH at the very top, did not want to hear … They said beta-amyloid is the cause of Alzheimer's disease. That made them heroes — they found the cause, so now they would find the cure …

But they don't want to look at it being something simple. There's no money to be made if you tell people, 'If you don't want to get Alzheimer's disease, don't expose yourself to mercury.'

Mercury is not the only cause. I would never say that, and I never did say that. I said, 'Mercury is the major exacerbating factor[7] *because we put dental amalgams in our mouth, and the major exposure, the source of mercury in our body, comes from them [sic] amalgams, according to the World Health Organization (WHO).'"*

The Transformation of a Skeptic

It's interesting to note that Haley was in fact highly skeptical of the idea that dental amalgam released mercury before he started studying the matter. Like so many others, he assumed the U.S. Food and Drug Administration and the American Dental Association would never allow something truly toxic to be placed in people's mouths.

His scientific investigations eventually convinced him that **amalgams** are a major source of mercury exposure that can indeed exacerbate and trigger chronic illness — something he details in his 2014 paper,[8] "Evidence Supporting a Link Between Dental Amalgams and Chronic Illness, Fatigue, Depression, Anxiety and Suicide."

Haley also recounts the twists and turns in his life that brought him to investigate the links between mercury toxicity and autism, and how vaccines can be a source of toxic mercury exposure. While thimerosal (mercury-based preservative) has been removed from many childhood vaccines, it's still used in some.

One tipoff that thimerosal was bad news came from a 1977 report from Toronto Hospital, where 10 of 13 infants died after having their umbilical region treated with merthiolate (thimerosal) to kill bacterial infection. Merthiolate is no longer in use, as it was discovered that these infants died from mercury toxicity.

This report revealed that thimerosal turned into ethyl mercury, which the infant body cannot eliminate. Despite that, a mere decade later, in 1988, the U.S. Centers for Disease Control and Prevention decided thimerosal was an appropriate preservative for use in vaccines given to newborn babies and infants.

How Genetics Influence Your Mercury-Elimination Capacity

Haley completed his Alzheimer's research in 1988, just over 30 years ago, yet he's never been invited to an Alzheimer's conference to present his work. He has also published a book in which he proposed a mechanism for why having two copies of the ApoE2 gene renders you more or less immune to Alzheimer's.

The ApoE2 gene has two cysteine molecules on the surface, whereas ApoE4 — which is a major risk factor for Alzheimer's — has two tyrosine molecules. These are amino acids on the structure. The cysteine amino acid on E2 binds effectively to mercury, whereas the tyrosine on E4 cannot bind to mercury at all.

As a result, having two copies of the ApoE4 gene places you at a significant disadvantage, as your brain cannot eliminate mercury naturally, whereas having two copies of ApoE2 is highly protective because your brain has the ability to clear out mercury.

It is also helpful to note that Dr. Dale Bredesen who wrote the book "The End of Alzheimer's," believes the ApoE4 allele may actually protect against Alzheimer's if you

are metabolically flexible and regularly engage in intermittent or partial fasting.

Therapeutic Interventions to Address Mercury Toxicity

Alzheimer's disease is associated with oxidative stress. While mercury is not a redox metal, meaning it cannot create hydroxyl free radicals, mercury does displace iron and kaempferol, and when mercury displaces iron, it stops ATP production in that electron transport system.

By displacing iron from the iron sulfur centers mercury also blocks the cytochromes, as cytochromes require iron to work. "There are publications now showing that mercury exposure totally screws up the metabolism of iron in the body," Haley says.

The chelating compound he developed, called emeramide or NBMI,[9] tightly binds to both mercury and free iron, which is also highly toxic. As such, emeramide can also be used in the treatment of hemochromatosis, a genetic disease that causes chronic iron overload.

Drawbacks of Most Popular Chelating Agents for Mercury

Haley also discusses the drawbacks of using dimercaptosuccinic acid (DMSA) or 2,3-dimercapto-1-propanesulfonic acid (DMPS) to detoxify mercury — the two most commonly used chemical chelators. According to Haley, they are in fact not true chelators. Rather they form a "sandwich complex" where each molecule of mercury will have two DMSA molecules attached to it, opposed to just one.

A significant problem is their ability to translocate mercury from the blood and other organs and concentrating it in the kidneys, thereby causing renal failure. What's more, most of the mercury is not in your blood but rather in your cells, and neither DMPS nor DMSA can enter the cell, Haley claims. They only remove mercury from your blood.

> *"I initially developed the idea that I had to have a hydrophobic chelator that would get into the mitochondria, into the DNA … Mercury is hydrophobic. It's*

uncharged. It's a gas. It goes through the biomembrane. You have to have a chelator that does the same thing.

[The mercury] starts out as a gas. It goes in as Hg0 when you breathe mercury vapor [from your mercury dental fillings], and then it goes wherever it wants. [If you're eating fish], then it will be methyl mercury, but it's the same thing. Methyl mercury is also membrane-permeable.

It goes right through membranes because it binds. It's CH3Hg+. But if it's in the blood, there's a high level of chloride, and chloride binds that negative charge, so you end up with some of the Hg methyl mercury in the chloride form that can go right through the membrane because it's uncharged. That's the reason it gets through the brain so effectively," Haley says.

"[T]hen, in the brain or in any tissue, it gets converted into Hg2+ by an enzyme called catalase … and then it becomes very toxic; it's charged, and then it won't go out [of the cell]."

Haley's Decision to Develop a Better Chelator

Haley's decision to develop a better chelating agent for mercury was the result of failed attempts to alert health authorities to the very real dangers of thimerosal in vaccines.

"One night I was sitting at home. I have a daughter who has a Ph.D. in molecular biology and toxicology. She called me up when she was writing her Ph.D. thesis. She said she found a website that mentioned me, and it wasn't very complimentary, to say the least.

She was kind of sad and teary. It made me angry that I just let those people go and say those things … I remember that night [in 2002] very vividly. I sat down with a glass of red wine … and said, 'How do I win? I can't out-PR these guys. You cannot out-PR the CDC' … That was the night I decided, 'I'm a chemist. I make things. I'm going to make a better chelator.' That's the way I went.

I wrote a grant. I got some funding to try and make the chelators that would enter the cells … If you're going to use a chelator, the first thing it has to be is nontoxic itself … It had to be hydrophobic [to] pass the blood-brain barrier and get in the cells …"

Haley recounts the history of how emeramide was developed — and describes the differences between it and DMPS and DMSA. Importantly, emeramide is nontoxic and binds very tightly to mercury. It's also a very potent antioxidant, with two glutathione "arms." (Glutathione is a powerful antioxidant produced in your body that is instrumental in detoxifying mercury and other toxins.)

Haley believes its antioxidant power comes from the glutathione components, which scavenge hydroxyl free radicals. Other testing showed each molecule of emeramide scavenges three hydroxyl free radicals. While it stops the toxicity, it does not repair any of the damage already done, which will need to be addressed through other means.

Why Was Haley's Initial Product Shut Down by the FDA?

Haley's first product, developed in 2006 and sold between 2008 and 2010 under the name Oxidative Stress Relief (OSR), was shut down by the FDA in 2010 after a complaint was filed. Haley explains the circumstances:

"When they shut me down, [my attorney, an FDA expert] told me, 'Dr. Haley, this is silly. The compound has in-structure, dicarboxyl benzoate, which is found in cranberries and cystamine, which is on the terminal end of coenzyme A. It's just cysteine without the carboxylic acid group. It's a natural product.

Two natural products [combined], just like slow-release niacin and n-acetyl cysteine … It can be [sold as] a natural product and a supplement if it contains any one of a natural product or any combination of two' …

That's what [the FDA rules] said. And then they changed that. We call it the Boyd Haley rule now. [The FDA] said, 'Not if you put [two natural products] together chemically' …"

In essence, Haley was targeted, and the FDA changed the rules to make their targeting stick. In the end, Haley chose not to fight the FDA in court. "I don't have that kind of money," he says. He closed down his business and no penalties or formal legal action were ever taken by the FDA. Haley's attorney told him he would need to develop a chemical chelator that doesn't exist naturally, and go through drug approval. This is the route he took with emeramide.

Emeramide Phase I Studies

Emeramide is the active pharmaceutical ingredient (API). The drug itself is called Irminix, and it is designated as an orphan drug for use as a mercury chelator in both the U.S. and the European Union, because neither the FDA nor the European Medicines Agency (EMA) have an official treatment for mercury toxicity.

> *"We got it started and we took it through all animal trials that they requested we do. You have to get incredibly high levels to have an effect on an animal — 100 times more than you would ever give a human being. We use 4 to 5 milligrams (mg) per kilogram of body weight to treat a person for mercury toxicity.*
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> *We were giving these animals a minimum of 290 mg per kilogram of body weight to make them sick. Some animals don't get sick at all. Humans don't. I mean it's different. But there's nothing in there that's not reversible. It's something that you stop and it goes away. It's totally safe …*
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> *We did all that, and then we got permission to do a Phase I study in Sweden. That's when you give the drug in single doses for a period of time and go up higher and higher, and then you give multiple doses for a week …*
>
> *We got up to 600 mg a day for two weeks in a Phase I study in humans with no adverse effects at all. I mean nothing happened; 600 mg is way more than you and I may ever need to take; 300 mg would be a good amount …*
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> *It peaks in your blood within two hours. About 60 to 80% … is absorbed … In test animals, we showed that it did the same thing and that it concentrates and it*

peaks in all tissues of the body at the same time. It gets in the brain. You get more of it in the kidney and the liver than you will get in the brain, but it does get into the brain. It crosses the blood-brain barrier and is effective in eliminating the iron out of the brain [as well] …"

Phase II Studies

Phase II studies were done on Ecuadorian gold miners, who use mercury during the refining and purification process, showing it decreased the mercury level in 10 of 11 miners. "Their urinary mercury levels dropped dramatically. Their blood levels went down also," Haley says.

"It was the people at the EMA advisory group who told us to go to South America or Africa or someplace where mining gold is thrust on those people. The adverse effects [of the mercury exposure] — stomachaches, headaches and diarrhea — were [also] dramatically improved in those who took the drug.

Mercury does all of this and some other toxic side effects. The problem with mercury is there's no endpoint that you can point at that the FDA will say they'll accept as a proof that you've done it."

Once you've taken the emeramide, the mercury is excreted through your stool. And, contrary to most other chelators, you are not required to use a binder to get it safely out. Haley adds:

"We've looked at the cytochrome P450 (CYP) enzymes or the P450 system and the mercury NBMI complex, which when it binds to it, it never lets go … The toxicity is eliminated very quickly when you take NBMI … [In] about a month, most of it is out … [after] just one dose."

The applications, of course, apply not only to those with mercury dental fillings, but also autistic children who have mercury toxicity, and people with neurodegenerative diseases such as Alzheimer's, ALS, Parkinson's, Huntington's and others. To hear anecdotal

reports of improvements and recovery for some these conditions, please listen to the interview in its entirety.

Haley has himself been taking about 200 to 300 mg of emeramide daily since 2006, as a preventive measure. He's now 78 years old, and claims the compound has helped him maintain his cognition. He also has the blood glutathione level of a teenager.

It may also help people who struggle with chronic obstructive pulmonary disease (COPD) due to smoking, which exposes you to high amounts of toxic metals. A Phase II study has also been performed on COPD patients to make sure it's not toxic for this groups of patients.

More Information

Emeramid is still under drug development but can be obtained via expanded access, named patient use, compassionate use or special use, depending on the country you're in. An early access application and prescription, required by the EMA, is available on the company's website, **EmeraMed.com**, along with more details by country.

If you have questions about the company itself, which is based in Ireland, you may request an information packet via email at **Info@EmeraMed.com**. While the product is given away for free to those who qualify for early access, a two-week treatment package costs about $600 for Irish medical board fees, insurance and mailing.

OSR used to sell for $30 for a month's worth of treatment and was sold as a dietary antioxidant. "When you make it a drug, it's a lot more expensive," Haley says. It's still unclear exactly how much Irminix (also now called emeramide and OSR#1)[10] will sell for.

> *"I mean it's definitely not going to be anything like ($600),"* Haley says. *"The real slow-down here is that if you're going to get it drug-approved, you have to show it's nontoxic. You have to do the Phase I study. And then you have to do the Phase II study and the Phase III study. Those are efficacy (tests) to show your drug works.*

How do you show that your drug is binding mercury in a group of Americans in which none of them — according to the FDA or to science or the NIH — are mercury-toxic? Because you have to be [at a certain level] in your urine level to be [considered] mercury-toxic.

That is scientifically incorrect because the people who don't excrete mercury have very low urinary and blood levels. They build it up in their cells, and that's what goes down [when using Irminix] …

We now have found a [test] group in Colombia, South America — A young boy found a jar of liquid mercury. He took it to his school, shared it with his friends. The process of all that made about 125 people very mercury-toxic, and they're not gold miners, so they're not being [continuously] exposed. We initiated a study in Colombia on those people, because they … do have very high levels. That'll be able to show [that emeramide works]."

Sources and References

- [1] PNAS September 1, 1974 71 (9) 3367-3371
- [2] Annals of Neurology 1989 Aug;26(2):210-5
- [3] Proceedings of the National Academy of Sciences December 15, 1992 89 (24) 11949-11953
- [4] Academictree.org Boyd E. Haley Scientific Publications
- [5] Journal of Trace Elements in Medicine and Biology September 2016; 37: 8-24
- [6] International Journal of Toxicology October 12, 2011
- [7] The Relationship of the Toxic Effects of Mercury to Exacerbation of Alzheimer's Disease, by Boyd Haley (PDF)
- [8] Neuro Endocrinol Lett. 2014;35(7):537-52
- [9] Emeramed.com
- [10] FandaChem