

[SpectrumNeeds™ a New Comprehensive Nutritional Therapy for Autism, Functional Conditions, and Mitochondrial Disease](#)

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Dr. Richard G. Boles completed medical school at UCLA, a pediatric residency at Harbor-UCLA, and a genetics fellowship at Yale. For over two decades, Dr. Boles' clinical and research focus has been on changes in genes involved in energy metabolism, and more recently ion channels, and their effects on the development of common functional disorders. Examples include autism, pain syndromes, chronic fatigue, cyclic vomiting, intestinal dysmotility/failure, and depression. Dr. Boles practices the "bedside to bench to bedside" model of a physician-scientist, combining an active clinical practice with basic research into the underlying genetic predispositions leading to the same conditions. He has over 80 published papers, mostly in mitochondrial medicine. For 20 years, Dr. Boles was a faculty member at the Keck School of Medicine at USC and a practicing medical geneticist and metabolic specialist at Children's Hospital Los Angeles. He was a Medical Director of Lineagen and Courtagen, which are/were genetic testing companies. Dr. Boles became involved in genetic testing in order to facilitate the translation of the vast amounts of acquired genetic knowledge into applications that improve routine medical care. Dr. Boles has an active private practice in Pasadena and Aliso Viejo, CA. About half of the patients he currently sees as a physician have one of more functional conditions, especially cyclic vomiting syndrome, other forms of complex migraine, and/or chronic fatigue syndrome. Most of the other half have an autistic spectrum disorder or related condition. His clinical practice is devoted to using information, including genetic testing, to guide options for therapy. His care philosophy, practice, and types of patients he accepts are discussed at <http://molecularmitomd.com>. A telemedicine practice has just started at <https://cnnh.org>. Dr. Boles also does legal consulting, especially for those with multiple functional conditions that others are considering fictitious disorder/Munchausen-by-proxy/medical child abuse. Finally, he is the primary designer of SpectrumNeeds™, a nutritional product with 33 active ingredients designed for individuals with autism or other neurodevelopmental disorders, with an emphasis on assisting mitochondrial function (<https://www.neuroneeds.com>).

**Slide 1:** Introduction of Dr. Boles from MaryBeth Hollinger

**Slide 2:** Disclosure: Dr. Boles wears many hats

I do need to talk about the conflicts of interests. We are going to be talking about nutrition and autism functional disease such as pain, fatigue, vomiting etc, as well as in mitochondrial disease. I have been doing this as you say for a quarter century now and most of my patients have been on 10, 20, even 30 or more different supplements. Families have been asking me for a long time to try to put something together to make that easier because it is crazy getting different supplements from different companies and putting them all together, the kid has to take a huge number of different tablets. I finally got together with some business people that I know and trust to put together the company of NeuroNeeds which produces our first product, SpectrumNeeds™. So in this talk I am going to be talking about what the nutrition is in autism and these other conditions and how to adapt it to mitochondrial disease but I want everyone to know that I am a part owner of the company of NeuroNeeds.

In addition to that I was on faculty at USC for twenty years, I have been off for a few years now but I still lecture there. I have had an active research component, I had NIH funding when I was at Children's Hospital. I still see a lot of patients, I see a lot of patients in my private practice in Pasadena and I have expanded into telemedicine. One of the important things that we are doing now is to use telemedicine to explain to the physician what a DNA diagnosis is, what a DNA report shows, and what you can do with it to treat the patient.

- Chief Medical & Scientific Officer of NeuroNeeds LLC – Present: The company that produces [SpectrumNeeds™](#)
- Medical Director for DNA Sequencing Companies
  - Past: 5 years at Courtagen Life Sciences; 6 months at Lineagen
  - Present: Loose affiliations with some companies
  - Roles: Test development, testing, interpretation, marketing
- Researcher with prior NIH and foundation funding
  - Past: USC faculty for 20 years
  - Present: Study sequence variation that predispose towards neurodevelopmental and functional disorders
- Clinician treating patients
  - Primary interests in functional disease (autism, cyclic vomiting)
  - Past: Geneticist/pediatrician 20 years at CHLA/USC
  - Present: In private practice since 2014 (<http://molecularmitomd.com>)
  - Present: Telemedicine as part of [CNNH NeuroGenomics Program](#)

### **Slide 3: Presentation Aims**

What does the medical literature say regarding the uses of nutritional therapies in the autism and related neurodevelopmental disorders? It is not just autism, it is off the spectrum as well, it is ADHD.

- What about the uses of nutritional therapies in functional disease such as pain, fatigue, GI dysmotility, dysautonomia, anxiety, and depression? These are related genetically to autism and ADHD.

- What exactly is SpectrumNeeds™, and how can it be used as nutritional support for the above conditions? This product can be used as a combination of products to meet almost all of those needs.

- SpectrumNeeds™ beyond the spectrum: What about the use of this product in the average “mito” patient? I am going to talk about how to adapt SpectrumNeeds™ for a more complicated mitochondrial patient. SpectrumNeeds™ is designed mostly for the neurodevelopmental disorders and neuropsychiatric disorders, but it also can be adapted to the average patient with mitochondrial disease even if there is no depression, anxiety, autism, ADHD etc.

- How to integrate SpectrumNeeds™ into a complicated supplement regimen.

### **Slide 4: Presentation Aims**

Metabolic pathways are extremely complex. There are thousands of metabolic pathways and this is just a very small part of it. So I am just showing you that even though this presentation may seem very complicated, it is actually just a very small snapshot of metabolism and the reason for the slide is to show that there is a lot going on here and that is why a comprehensive approach may be better.

### **Slide 5/Slide 6: Nutritional Support in Autism**

This is meant for autism but as I will get to a couple of slides later, it really is more adaptable to the whole neurological condition in mitochondrial disease. There are a very large number of nutrients that may or may not be useful in autism and many of them have been tested. These six nutrients are the ones that there is the most literature, the most scientific and medical literature available, these are the six that are the best studied, maybe not the most important ones, but they are in particular use.

- Scientific research and clinical experience illustrating that people with autism spectrum and other neurodevelopmental disorders function better when certain

nutrients are supplemented at high doses.

• The data supporting nutritional support in autism is strongest for the following nutrients:

- Carnitine
- Coenzyme Q10
- Magnesium
- Pyridoxine (vitamin B6) – Cobalamin (vitamin B12) – Vitamin D3

Slide 6 is just to show you that these nutrients are in SpectrumNeeds™.

### **Slide 7:**

All of these nutrients are important in energy metabolism and are standard components of the “mitochondrial (mito) cocktail”. These are all important aspects of mitochondrial metabolism and certainly if you are talking about nutritional components for autism or ADHD or for anxiety or depression, when you look at the literature, what has been tested and showed to make a difference is really mito cocktail, because there is probably a mitochondrial component to a large number of people with these conditions.

### **Slide 8: Mitochondrial Metabolism in Autism**

Many of you probably know that there is a major connection between autism and mitochondrial disease. Many people with mitochondrial disease have either autism or one of the related neurodevelopmental disorders, it may be off spectrum, it may be ADHD, there is a very large number of those. But also in autism in general there is a degree of mitochondrial dysfunction that at least half of patients and I suspect it is more like two thirds, of patients with run of the mill autism that are out there with no diagnosis, have a degree of mitochondrial dysfunction when you test them. That doesn't mean that half or more of patients with autism have mitochondrial disease, it means that there is a component of mitochondrial dysfunction, there are many other components, autism is very genetically complicated, but one of the things that is important is that in the run of the mill patient with autism is that the mitochondrial cocktail is often helpful, and it is something that should be considered.

What is the mitochondrial cocktail? If you get twenty different mito doctors you will get twenty different answers. There are 10 or so core parts of the mito cocktail, everyone has a different list as to what is more important. Many of the patients are on this and the specialists recommend it from time to time depending on the patient's DNA results and dependent on someone's clinical manifestations, do they have migraines, do they have constipation, etc. I put some of the core components of the mitochondrial

cocktail, there are certainly some components that are not on the list. I realized that the mineral selenium was excluded from the slide, so please add that to the left side column. All of these components are in SpectrumNeeds™. The 6 that have the best evidence in autism are in blue. In the little insert is a muscle fiber and those white ovals are mitochondria.

1. The scientific research that reveals about one-half of individuals on the autism spectrum have mitochondrial deficiencies (see Frye & Rossignol).

2. The “mito-cocktail” refers to combined nutritional support for mitochondrial dysfunction.

3. The mito-cocktail is ill-defined, but generally consists of about 10-30 different nutrients.

4. SpectrumNeeds™ includes the following components of the mito-cocktail:

- Acetyl L-carnitine
  - Alpha ketoglutarate
  - Alpha lipoic acid
  - Carnitine
  - Coenzyme Q10
  - Creatine
  - Magnesium
  - Zinc
  - Vitamins
- B1 (thiamine)
  - B2 (riboflavin)
  - B3 (niacinamide)
  - B5 (pantothenate)
  - B6 (pyridoxine, pyridoxal-5-phosphate)
  - B7 (biotin)
  - B12 (methylcobalamin)
  - C
  - D3
  - E

#### **Slide 9:** Mitochondrial Medicine The Spectrum of Mito

This comes from the USDM website of mitochondrial associated problems, you can see in green there autistic features or autism, but there are many others. Many of them involve the nervous system as you know that mitochondrial disease predominantly affects the neurological system although it can affect other systems as well, probably

because nerves are electrical, and require a lot of energy.

#### Brain

- Developmental delays
- Dementia
- Neuro-psychiatric disturbances
- Migraines
- Autistic Features
- Mental retardation
- Seizures
- Atypical cerebral palsy
- Strokes

#### Nerves

- Gastrointestinal problems
- Dysmotility
- Irritable bowel syndrome
- Hypotonia
- Muscle pain
- Gastroesophageal reflux
- Diarrhea or constipation
- Pseudo-obstruction

#### Kidneys

- Renal tubular acidosis or wasting

#### Ears & Eyes

- Visual loss and blindness
- Ptosis
- Ophthalmoplegia
- Optic atrophy
- Hearing loss and deafness
- Acquired strabismus
- Retinitis pigmentosa

#### Pancreas & other glands

- Diabetes and exocrine pancreatic failure

(inability to make digestive enzymes)

- Parathyroid failure (low calcium)

#### Systemic

- Failure to gain weight
- Fatigue
- Unexplained vomiting

- Short stature
- Respiratory problems

**Slide 10:** Case Study: Autism & Chronic Pain: Big Zach

Big Zach is one of my first cases reports that I give, because I think that it is so interesting in many different ways. He is about 24 now, he is still autistic but that is not what ails him the most, he came to me because of cyclic vomiting syndrome because that is what I do.

- Autism – early infancy
  - Lost language skills acquired at 18 months.
  - Diagnosed with autism at age 2 years.
- Cyclic vomiting syndrome – age 6 years
  - Episodes of nausea, vomiting and lethargy lasting from a few days to a week or more.
- Bowel dysmotility
  - Hospitalized many times for “clean-outs”.
  - Multiple procedures to place tubes in different bowel segments.
- Major Issue was Complex regional pain syndrome – age 12 yrs
  - Episodes in which right foot becomes cold, purple, tender, allodynia (touch is interpreted as pain), unable to bear weight; wheelchair bound for months, was disabled for about a year or so in a wheelchair. On very high doses of opiates, unable to wean off of them.
- Other chronic intermittent symptoms
  - Headache, muscle pain, photophobia, ptosis, tics, hours-long episodes of hiccups.
- Severe exercise intolerance
  - The family showed maternal inheritance and we did find something in the mitochondrial DNA but that is not all that he has.

**Slide 11:** Case Study: Autism & Chronic Pain: Big Zach

Autism

- Complex regional pain syndrome
- Cyclic vomiting syndrome
- Bowel dysmotility
- Severe exercise intolerance

Case Study: Autism & Chronic Pain: Big Zach

- Biochemical laboratory testing strongly suggested a mitochondrial disorder.
- Placed on mitochondrial cocktail:
  - Alpha lipoic acid
  - Coenzyme Q10
  - L-carnitine
  - Riboflavin
  - Vitamin B complex
  - Vitamin C
  - Vitamin D3
- Cocktail was associated with substantial improvements:
  - Pain-free and weaned off opiates
  - Cyclic vomiting episodes stopped

He was also put on other medications, but the mitochondrial cocktail was a major component in his improvement.

#### **Slide 12:** Case Study: Singleton Autism: TRAP1 Carter

- Presented at age 1 year following the MMR vaccination in which he stopped developing speech for the next year.
- He was later diagnosed with an autistic spectrum disorder.
- Biochemical laboratory testing had suggested the possibility of a mitochondrial disorder.
- Placed on basic mitochondrial cocktail:
  - Coenzyme Q10
  - Creatine
  - Folinic acid
  - L-carnitine
  - Riboflavin
- Cocktail “opened his brain”: talking more, more socially and emotionally engaged, can reason with him better and less temper tantrums.

So these are the kind of studies that you are used to hearing about in mitochondrial disease, that a patient will have clinical presentations, may or may not have autism, has biochemical data to suggest that they have a mitochondrial dysfunction, if not a mitochondrial disorder, is placed on a mito cocktail and not only do manifestations improve but autism improves.

In the next six slides I’m not going to talk about this in detail, but you can go back and look at it, because it will be on the MitoAction website, but I am going to go over those six key parts of nutrition here.



### **Slide 13: Nutritional Support in Autism Carnitine and Acetyl Carnitine**

What It Does:

1. Ferries long-chain fatty acids into mitochondria.
2. Detoxifying by ferrying incompletely oxidized metabolic intermediates (intermediates can not be processed completely because of mitochondrial dysfunction) out of the mitochondria
  - Deficiency: Fatigue, weakness, cardiomyopathy
  - In ASD: Several published studies have shown positive effects of carnitine supplementation in individuals on the autistic spectrum, including a reduction in autistic behaviors.
    - Forms: Acetyl carnitine (ALCAR) is a form of carnitine that can more easily cross membranes, and thus is used for a variety of brain disorders.
    - Side Effects: Rare at moderate dosing; can include a fishy odor that can be treated by riboflavin or antibiotics.
    - Caveats: Critically important in patients with metabolic disorders. Laboratory testing can help optimize supplementation; levels of free carnitine in the blood over 30 to 40  $\mu\text{mol/L}$  are associated with improved outcomes.

Some people say that carnitine is better, L-carnitine, some people say that acetyl carnitine is better, I looked at the literature, I couldn't make a decision, I put both of them in the product.

### **Slide 14: Nutritional Support in Autism Coenzyme Q10 (CoQ10)**

If you ask twenty mito doctors what is in the mito cocktail, everyone will say something different, but everyone will say CoQ10 and 9 out of 10 will say carnitine, if not all of them. This is really a key component of the mitochondrial cocktail regardless of what you are treating.

What It Does:

1. Electron carrier in the respiratory chain.
2. Antioxidant, protecting the body (particularly the nervous system) from damage caused by ROS, reactive oxygen species.
  - Deficiency: Mitochondrial disease, including fatigue, weakness, cardiomyopathy
  - In ASD: One study in children with ASD reported that significant improvements were noted, including in communication and social skills as well as sleeping. However, the role of coQ10 in the treatment of autism is mostly driven by its antioxidant properties for the treatment of mitochondrial dysfunction.

- Forms: Ubiquinol has better bioavailability than the usual form of ubiquinone, but is not stable in powder form.
- Side Effects: Rare at moderate dosing, except for insomnia if given at bedtime.
- Caveats: Critically important in patients with mitochondrial disorders. Laboratory testing can help optimize supplementation; levels over 3-4 mg/L are associated with improved outcomes. May require additional supplementation.

### **Slide 15: Nutritional Support in Autism Magnesium**

If you do not consider magnesium to be a key part of the mitochondrial cocktail, reconsider. One of the basic concepts that I am going to discuss, is idea of neuro protection. There are three parts of the triad of nutrition, there is mitochondrial cocktail, which you know about and I will talk about more, there is neuro protection and there is basic comprehensive nutrition. Magnesium is important for all three aspects.

What It Does:

1. Mineral required for the function of over 300 enzymatic reactions, including in energy metabolism where it plays a pivotal role.
2. Agonist for GABA receptors and an antagonist for NMDA glutamate receptors. This is involved in neurotransmission, and is very important for neuro protection.
  - Deficiency: Common, particularly in vulnerable populations, including people with GI disease; loss of appetite, nausea, vomiting, fatigue, weakness, anxiety, memory problems, numbness and tingling, tics, cramps, insomnia, seizures, personality changes, and abnormal heart rhythms.
  - In ASD: Evaluated in a few studies, some of which have shown benefit, especially when coupled with pyridoxine.
  - Forms: Supplements are available over-the-counter in a variety of forms, some are more bioavailable than others. Mg glycinate and Mg citrate are often recommended.
  - Side Effects: Rare at moderate dosing except for loose stools with Mg citrate.
  - Caveats: Also helpful for constipation, migraine/chronic pain, fatigue, restless leg, signs of insulin resistance, and indications of reduced inhibitory–excitatory balance (anxiety, hyperactivity, impulsivity, OCD, etc.).

### **Slide 16: Nutritional Support in Autism Pyridoxine and P5P (vitamin B6)**

A major component in the mitochondrial cocktail but not often considered as such.

What It Does:

1. Vitamin required for the function of over 100 enzymatic reactions, including in

metabolism where it plays a pivotal role.

2. Involved in critical pathways such as neurotransmission, myelination, and gene expression.

- Deficiency: Fatigue, weakness, depression, peripheral neuropathy, seizures
- In ASD: Evaluated in a few studies, some of which have shown benefit, especially when coupled with magnesium.
- Forms: Activated form is pyridoxal-5-phosphate (P5P, PLP)
- Side Effects: Rare at moderate dosing.
- Caveats: One study suggests that pyridoxine activation may be defective in ASD, arguing for P5P supplementation.

### **Slide 17:** Nutritional Support in Autism Methylcobalamin (vitamin B12)

B12 is important because it is often deficiency, particularly if the patient doesn't eat a lot of animal protein. A lot of people have B12 deficiency because of GI disease. If you have irritable bowel syndrome you are likely to have a B12 deficiency. It is important for mitochondrial function and it has been associated with a lot of neurological problems from autism to depression, anxiety, neurological degeneration or loss of milestones.

What It Does:

1. Cofactor for enzymes in metabolism.

2. Role in myelination.

- Deficiency: Common, including fatigue, weakness, problems walking, psychosis, and behavioral changes, which may be irreversible.
- In ASD: Several studies in children with ASD using methylcobalamin injection have revealed improved glutathione metabolism or methylation and/or significant clinical improvements, especially in adaptive behaviors.
- Forms: Activated form is methylcobalamin.
- Side Effects: Rare at moderate dosing.
- Caveats: Oral dosing has not been well studied in ASD, but makes sense to try prior to progressing to injections.

### **Slide 18:** Nutritional Support in Autism Vitamin D3

It has become a lot more in vogue with mitochondrial specialists to measure vitamin D levels, that's 25-hydroxyvitamin D3 in the blood, and to supplement if low. Most people in the United States likely have a Vitamin D deficiency, they wear sunscreen, and particularly sick children who are indoors a lot.

What It Does: In addition to its role in bone, vitamin D has several other effects, including on brain development, neurotrophic and neuroprotective actions, neurotransmission, synaptic plasticity, immune function, and regulation of gene expression.

- Deficiency: Common even among individuals with light skin tones.
- In ASD: Several studies have documented that vitamin D deficiency is common among children with ASD. In one study, 87% had 25-hydroxyvitamin D levels below 30 ng/ml. A few clinical trials have demonstrated clinical improvement in children with ASD following supplementation, including in 81% with better outcomes with treatment blood levels over 40 ng/ml.
- Forms: 25-hydroxyvitamin D3 is the active form, which is easily made from vitamin D3.
- Side Effects: Rare at moderate dosing.
- Caveats: Monitoring blood levels of 25OH-vitamin D is important in monitoring therapy. Aim for a level > 30, possibly > 40.

**Slide 19:** Case Study: Autism as Part of a Complicated Condition: Kelly

Very gifted at art, this is her self portrait, and I have a lot of her work in my office. She does not speak at all, she can speak to her mom but she uses a computer program which speaks in Siri's voice. She manipulates the computer to speak in entire sentences. She is actually very bright.

- Presented to my clinic as a teenager
- Autistic spectrum disorder
- Main issue was continuous migraine headache
- Chronic fatigue syndrome – severe, disabling.
- Bowel dysmotility/IBS
- Dysautonomia, including tachycardia and POTS
- Depression and anxiety – severe, disabling

**Slide 20:** Case Study: Autism as Part of a Complicated Condition: Kelly

- Found through DNA sequencing to have two predicted mutations were identified in the glutamate 2 gene, the gene that encodes an enzyme that converts glutamine (amino acid) to glutamate (major excitatory neurotransmitter) This was unexpected at first but then I realized that glutamate, in addition to being an excitatory neurotransmitter which may be causing a lot of her neurological problems, goes to alpha-ketoglutarate in

the Krebs Cycle.

- This gene/protein regulates cellular energy metabolism by increasing production of glutamate and alpha-ketoglutarate.
- Started on alpha-ketoglutarate supplementation.
- “The supplements seem to have made a remarkable difference! Her symptoms are much better controlled and mostly manageable & she has been able to resume some of her daily activities & a small amount of local travel. This has lifted her spirits greatly. It hasn't "cured" it all but it is quite a miracle all the same.”
- And Alpha-ketoglutarate is part of SpectrumNeeds™.

### **Slide 21:** Dietary Deficiencies in Autism

I spoke a little bit about vitamin deficiencies that are really common particularly vitamin B12 and D3, but all of the ones on the slide here are known to be deficient in children with autism in general. In part because they eat very restricted diets. The ones in blue here again are the top six, four of them are often deficient in autism. But this is not the main reason to use a combination product or for the matter any sort of mitochondrial cocktail.

Children on the autism spectrum often have diets that are deficient in many nutrients shown by low levels in blood or hair.

- Choline
- Chromium
- Magnesium
- Manganese
- Molybdenum
- Selenium
- Zinc

#### Vitamins

- B1 (thiamine)
- B5 (pantothenate)
- B6 (pyridoxine, pyridoxal-5- phosphate)
- B7 (biotin)
- B9 (folate)
- B12 (methylcobalamin)
- C
- D3
- E

## **Slide 22: Dietary Deficiencies in Autism**

The main reason to use the mitochondrial cocktail is in the next slide the little green area will explain, is to push metabolism in the direction that we believe is healing. To use not just the RDA (recommended daily allowance) of the vitamin to correct the deficiency but to use a lot more and sometimes as much as a thousand times as much of RDA to push the biochemical product in the direction that we want to go.

To take the metabolic pathways and push them where we want them to go to try and help the situation. So when we are talking mitochondrial cocktail yes to some degree it is taking a deficiency and correcting it, but for the most part what we are talking about is actual therapy and moving pathways in certain directions and that is why I thought a good diet is very important, and again I certainly recommend it to all my patients, a good diet is not enough, you couldn't possibly if you ate the entire salad bar at every restaurant on restaurant row you would not get enough of these vitamins, supplementation is needed as well.

## **Slide 23: Activated Form of Nutrients**

Just taking a multivitamin tablet is not going to be good enough in most cases. For one, the amount is very low. If you looked at riboflavin (vitamin B2) a standard multivitamin will be about 1 milligram. If you look at what is in a multivitamin, it can be 1.3 mgs, 3 mgs, some of them are up to 25. But if you are looking at what we use to treat this disorder, we used between 25 and 400 mgs. So a multivitamin in most cases is going to have very low doses. But it is also not going to have the activated forms. On this slide there are 3 particular B vitamins - most supplements do not give the activated form, we have already discussed the activated form of B6, but there is also folate (B9) and B12. The activated form is very important, in SpectrumNeeds the activated forms of these are given. In particular in folate there are two different ones, the activated folate and the next one folinate which goes across the blood vein barrier directly to the brain.

Standard multivitamin supplement may not always be absorbed and utilized.

- Activated vitamin B6 as pyridoxal 5-phosphate (P5P)
- Activated vitamin B9 (folate) as
  - 6S-5-L-methyltetrahydrofolate glucosamine calcium folinate
- Activated vitamin B12 as methylcobalamin

## **Slide 24:** The Science Behind Supplements The Adams Study

Unfortunately because of the vast majority of the medical literature is based upon drug company studies. Because they are the ones that have the money. The drug companies spend about five times more than the entire NIH budget. The drug companies of course are going to need a return from their investment, the idea is that if the drug is effective, they will put a patent on it and exclusivity for 25 years or so. Nobody is really studying nutrition because you can't patent something that is natural, anyone can do it. So there are very few studies and the studies tend to be smaller. It doesn't mean that there are not studies and that they isn't evidence. I'm going to go over some of that. The Adams study is probably the most important in this area, in particular for neurodevelopmental disorders.

Effect of a vitamin/mineral supplement on children and adults with autism. Adams et al, 2011, PMID 22151477.

- Randomized, double-blind, placebo-controlled
- 141 children and adults with autism
- 3-months of placebo or a vitamin/mineral cocktail consisting of 31 ingredients
- Improvements in the PGI-R (Average Change,  $p = 0.008$ ), and on the subscores for Hyperactivity ( $p = 0.003$ ), Tantruming ( $p = 0.009$ ), Overall ( $p = 0.02$ ), and Receptive Language ( $p = 0.03$ ). I see this in my patients as well, particularly in focus.
- Blood tests showed improvements in methylation, glutathione, oxidative stress, sulfation, ATP, NADH, and NADPH.

## **Slide 25:** The Science Behind Supplements The Kaplan Studies

Study: Treatment of Mood Liability and Explosive Rage with Minerals and Vitamins: Two Case Studies in Children

There is a set of Kaplan studies, by Bonnie Kaplan, one of the main authors, looking at another vitamin supplement, a multivitamin supplement in patients with many other disorders. I put a couple slides on here that I thought were more important because mood liability and explosive rage certainly have been a major problem in patients in my practice and I see that in a lot of patients with mitochondrial disease whether or not they have a diagnosis of autism or ADHD. They get into episodes where suddenly they act out. Particularly the school age children. This was showing that a vitamin cocktail was very helpful.

### **Slide 26:** The Science Behind Supplements The Kaplan Studies

- This formula is very similar to the general nutrition aspects of SpectrumNeeds™.
- What is absent in this formula is the high-dose mitochondrial cocktail.

The Kaplan Formula is a comprehensive, nutritional, platform that also has neuroprotection. But it is quite low on the mitochondrial cocktail. It has a little bit of the ingredients in there, but they are not very high in particular it is devoid of things like carnitine and coQ and some of the main ones. But it does have multi nutrition and in many ways is very similar to SpectrumNeeds.

### **Slide 27:** The Science Behind Supplements The Kaplan Studies

Study: Systematic review of safety and tolerability of a complex micronutrient formula used in mental health

This is similar to what the Adams study did. They found that patients tolerate these multivitamin contractions extremely well. I found the same with SpectrumNeeds, probably 50 of my patients are on it to date and there hasn't seem to be any problem, as well as in our first tolerability study, no side effects were noted except the usual with CoQ if you take it late at night it can energize you and you can have a hard time going to bed in one out of six patients, we have seen that a couple of times. But I haven't seen anything else. You just give it at dinner instead of when going to bed. It is better to give a multivitamin, regardless of what it is with food anyways.

### **Slide 28:** The Science Behind Supplements Additional Studies

Here are some additional studies I'm not going to go into that in detail, if you are interested in looking up more about the literature about how nutritional supplements can be helpful in neurological disorders and autism in general it is on that slide.

- Micronutrients Versus Standard Medication Management in Autism: A Naturalistic Case–Control Study; PMID 20415604.
- Systematic review of safety and tolerability of a complex micronutrient formula used in mental health; PMID 21501484.
- Treatment of Mood Lability and Explosive Rage with Minerals and Vitamins: Two Case Studies in Children; PMID 12427294.



- Nutritional and metabolic status of children with autism vs. neurotypical children, and the association with autism severity; PMID 21651783.
- The effect of dietary supplements on clinical aspects of autism spectrum disorder: A systematic review of the literature; PMID 28438367.
- How nutritional status, diet and dietary supplements can affect autism. A review; PMID 23789306.
- Dietary Supplement for Core Symptoms of Autism Spectrum Disorder: Where Are We Now and Where Should We Go?; PMID 28878697.
- Identification and Treatment of Pathophysiological Comorbidities of Autism Spectrum Disorder to Achieve Optimal Outcomes; PMID 27330338.
- A comprehensive systematic review and meta-analysis of pharmacological and dietary supplement interventions in paediatric autism: moderators of treatment response and recommendations for future research; PMID 28091344.
- Metabolic approaches to the treatment of autism spectrum disorders; PMID 11098885.
- Novel and emerging treatments for autism spectrum disorders: a systematic review; PMID 19917212.

### **Slide 29:** Nutritional Support in Autism SpectrumNeeds™

SpectrumNeeds™ is based on the Adams formula.

- Increases Nutritional Support (Adams +) - t corrects dietary deficiencies
- Corrects Dietary Deficiencies (incl. rare trace nutrients)
- Promotes Mitochondrial Metabolism (high dose)
- Activated Form (B6, B9-folate, B12)
- Expert Formulation (see creators above)
- High Quality (USA, CGMP)

These are some of the people who are involved with that. Some of you might know Dr. Richard Frye, who is very important, one of the ones that published most of the studies on autism and mitochondrial disease, a well known mitochondrial physician and scientist. There is also Dr. Dan Rossingol who is very well known in the autism world, as well as many others.

### **Slide 30:** Nutritional Support in Autism SpectrumNeeds™

However, there are some substantial differences between SpectrumNeeds™

and the product studied by Adams et al. SpectrumNeeds™. The main thing is that I increased the mitochondrial cocktail dramatically. The Adams Formula provides neuroprotection plus comprehensive nutrition, if you add the mitochondrial cocktail on top of that as a sort of marriage you get SpectrumNeeds. Most of the things were increased, a couple things were decreased because I wanted to make sure that nobody had nausea. In particular Zinc and Vitamin E can be major concerns with nausea. They were reduced in this formula so that they are at the levels that almost all children can tolerate.

- Includes alpha lipoic acid, a powerful antioxidant. (half or less than what is usually given so everyone can tolerate it)
- Includes creatine to promote neuronal energy metabolism.
- Includes carnitine and acetyl carnitine to assist in removing harmful organic acids from mitochondria.
- Includes activated vitamin B6 (P5P), which has emerging associations with brain disorders.
- Includes the Krebs cycle intermediates alpha ketoglutarate, citrate, and malate, to promote energy metabolism.
- Includes arginine to assist with small vessel circulation in the brain and elsewhere.
- The dose of vitamin B5 (pantothenate), which is the source of coenzyme A required in multiple enzymes, is 20 times higher.
- The dose of coenzyme Q10, a crucial nutrient in mitochondrial energy metabolism and antioxidant, is 5 times higher.
- The dose of vitamin D, which is associated with ASD in many studies, is doubled.
- The dose of magnesium, which is important for energy metabolism and selected neurotransmission, is doubled.
- Has higher amounts of both activated folate and folinate, the latter of which provides folate directly to brain.

### **Slide 31:** Nutritional Support in Autism SpectrumNeeds™ – Back of Label

The lefthand numbers are per dose, it is supposed to be given twice per day, breakfast and dinner or breakfast and bed time are what most people do, bedtime with a snack if possible. You would have to double these for what is given per day in a school age kid because this is per serving as the RDA requires. On the right hand side you can see that it is dosed depending on the weight, so that infants are going to get a lot less than adults and that is how it should be. I

t says how many scoops to put in there, so for a school aged child it would be 2

scoops in the morning, 2 scoops in the evening, or 4 scoops a day. A container will last a month. At worst you are talking about 3 scoops in the morning, 3 scoops in the evening for an adult, the container will last 20 days. For a toddler it will last 2 months. It is GMO free, it is artificial flavor free, in fact the flavors are citrate, which is a mitochondrial cocktail as well, that is a major part of it, there is some stevia in there and monk fruit is actually one of the major parts of what makes it taste good. We had a tasting booth at the MedMaps conference in March, and over 80 different physicians came by to taste it, and it really is a good tasting product, I think that the manufacturer did an excellent job at putting natural components in there, most kids like the taste. It goes well with water but you can also put it with juice.

### **Slide 32:** Case Study: Singleton Autism: Carter – After Genetic Testing

I've already discussed Carter before, he had a significant improvement but I don't want anyone to think that DNA testing is not necessary.

- Presented at age 1 year following the MMR vaccination in which he stopped developing speech for the next year.
- He was later diagnosed with an autistic spectrum disorder.
- Biochemical laboratory testing had suggested the possibility of a mitochondrial disorder.
  - Placed on basic mitochondrial cocktail:
    - Coenzyme Q10
    - Creatine
    - Folinic acid
    - L-carnitine
    - Riboflavin
  - Cocktail "opened his brain": talking more, more socially and emotionally engaged, can reason with him better and less temper tantrums.
- Years later, genetic testing revealed a disease-associated variant in the TRAP1 gene at p.Ile253Val. This is a variant that is seen in 1% of the population but it is one that see in a lot of my patients with autism particularly the ones with a functional disease.

### **Slide 33:** Case Study: Singleton Autism: Carter – After Genetic Testing

Based on the TRAP1 mutation, following informed consent, a drug determined by in silico design (a computer program) was tried in Carter. It binds to the mutant TRAP1 molecule but it doesn't bind to the wild type (normal) TRAP1 molecule. This was done

by colleagues at Georgia Tech who used the entire Georgia Tech computer system over a weekend to put every known chemical known to man in the computer to see what would bind to the mutant or the abnormal TRAP1 and not to the normal one. Based upon that we came up with a drug which is in the formula and we gave that to him.

He improved dramatically. Before this they can could never go to a restaurant, he was making animal sounds, after this he was able to sit down at the table and eat. And they can go to restaurants and their lives changes dramatically. The anecdotal results were clear and dose-dependent, in that on the drug Carter was:

- more talkative, expresses himself better
- more clever
- more focused\*
- less aggressive\*
- less sensory integration issues\*
- gets along better with his older brother
- more tolerate of previously-difficult situations.

So an overall nutritional component is important and I use SpectrumNeeds in my clinic to be at the baseline of nutrition to which I add additional components based on what the DNA shows and what the patient is showing me. But this is to show you that DNA testing still has a place.

**Slide 34:** Case Study: Autism & Chronic Pain: Big Zach – After Genetic Testing

- Autism
- Complex regional pain syndrome
- Cyclic vomiting syndrome
- Bowel dysmotility
- Severe exercise intolerance
- Biochemical laboratory testing strongly suggested a mitochondrial disorder.
- Placed on mitochondrial cocktail.
- Cocktail was associated with substantial improvements.
- Years later, genetic testing revealed a likely disease-associated variant in the CHAT gene that encodes for the enzyme that catalyzes the synthesis of acetylcholine (one of the major neurotransmitters) in cholinergic neurons.

**Slide 35:** Case Study: Autism & Chronic Pain: Big Zach – After Genetic Testing

He was put on a drug that inhibits the breakdown of acetylcholine in the synapses. Based on this, he improved dramatically. Following informed consent, an anticholinesterase drug was tried in Zach. The anecdotal results were clear and dose-dependent, in that on the drug Zach was:

Went from echolalia (you say something, he would say it back you) to being far more talkative, expressing himself better, even speaking in complete sentences. Sometime he would explain what he was doing. It made a huge difference on this to be able to recreate the synaptic environment. That doesn't say that he didn't have a mitochondrial disease, he has mitochondrial dysfunction but also has abnormality with neurotransmission. Most of my patients when we do full sequencing they don't have a mutation in one gene but they have mutation in 2, 3, 5, 7, genes, that contribute to make the disease. This is why the genetics is so complex and it is so difficult to make a diagnosis.

### **Slide 36: Nutritional Support in Autism Beyond SpectrumNeeds™**

The X on top of the SpectrumNeeds picture means this is beyond it. SpectrumNeeds in autism is going to meet the vast majority of the nutritional needs of the patient, but there are two major issues to consider on top of that.

#### •Omega-3 long chain polyunsaturated fatty acids (“Omega 3s”):

– The only nutrient that experts often recommend in neurodevelopmental disorders that is absent from SpectrumNeeds™.

– These fatty acids are not well absorbable from a powder, they are not stable in a powder form so they are not in SpectrumNeeds.

– However, omega 3s have been demonstrated to be low in patients with autistic spectrum disorders and supplementation with omega 3s has been demonstrated to have some efficacy. It has shown to be helpful not only in autism and ADHD but also depression and many other neurological disorders. This is fish oil. You can get it from wild caught salmon, it can't be farm raised because it actually comes from the plankton which the salmon eat in the ocean, not from the corn which is given by a farm. Most people get this in tablets or gel capsules because it is an oil, so this would have to be on top of SpectrumNeeds.

#### •Coenzyme Q10 (coQ10):

– SpectrumNeeds™ has a high dose of this nutrient, but may not be sufficient in every individual to achieve desirable blood levels (over 4.0) and nutritional goals. So you would need to give additional CoQ10. There are two types of CoQ, ubiquinone and ubiquinol.

– Discuss with your health care provider regarding blood testing for a coQ10

level and/or additional supplementation with ubiquinol, a form of coQ10 that is poorly absorbable from powder, and thus not included in SpectrumNeeds™.

•Others - additional information is our website:

On top of that, there is no way that anyone could ever design something that is perfect for everybody. SpectrumNeeds was meant to be a baseline for what you can give, 33 different active ingredients and on top of that you can give additional. Depending on what kind of problem the patient has in terms of the clinical, such as migraine, constipation, in particular, ADHD, hyperactivity issues, certain things may need to be given at a higher dose or to add additional components.

- B12, folinate, Mg, Zn: High dosing may not be high enough in some
- Copper/Iron/Calcium\*/vitamin A: Excluded for potential toxicity in some patients with autism, mitochondrial disease or ADHD etc. Those were taken out so that there wouldn't be a problem in anyone. In particular Vitamin A can be toxic if given in higher doses and many patients are on other supplements as well and I didn't want to add to the Vitamin A that they might already be on.
- Some providers will want additional supplementation in some patients.

\*There is very little calcium in SpectrumNeeds

### **Slide 37: Adapting SpectrumNeeds™ For Mitochondrial Disease**

You might be saying 'This is a MitoAction talk, you have been talking a lot about autism, what about for mitochondrial disease?' Well it works very well in mitochondrial disease and my patients with mitochondrial disease a lot of them I am recommending it. The reason is that with mitochondrial disease you certainly want the mito cocktail, and this is a very high potent mito cocktail with 20 different mito cocktail ingredients in it.

On top of that, neuroprotection is something that is not spoken about by most people in this area but it should be more. There are some people like Bob Naviaux that talk about this but there are many others where it is not spoken enough. There are many parts of SpectrumNeeds which are very helpful, arginine can help in many patients with stroke or stroke like episodes or dysautonomia. Magnesium and Zinc are both very helpful as neuroprotective agents, in particular they increase GABA the inhibitory neurotransmitter, they decrease the NMDA glutamate transmission which is the excitatory neurotransmitter and there are many others. So it is in addition to mitochondrial cocktail SpectrumNeeds is neuroprotection and essentially comprehensive nutrition.

So how do you adapt it? Say you have a patient with known or severe mitochondrial disease, not just mitochondrial dysfunction. This slide gives you some of

the ideas of some things that you may need to add more in. In particular, I have already discussed it that coQ10 needs to be increased.

Coenzyme Q10 (coQ10):

- SpectrumNeeds™ has a high dose of this nutrient, but may not be sufficient in every individual to achieve desirable blood levels and nutritional goals.
- Discuss with your health care provider regarding blood testing for a coQ10 level and/or additional supplementation with ubiquinol, a form of coQ10 that is poorly absorbable from powder, and thus not included in SpectrumNeeds™.

### **Slide 38: Adapting SpectrumNeeds™ For Mitochondrial Disease**

As always, consult your physician before making any supplement changes and anything regarding nutrition, because it makes such a big difference, and this is no exception. SpectrumNeeds and you need to talk more, but any sort of change to your formulation should be discussed with a physician.

If you take SpectrumNeeds and you say 'How do I make that a really high mitochondrial cocktail for a patient with mitochondrial disease' you would add additional:

- Alpha lipoic acid – strong antioxidant, but limited by nausea [add 100 mg BID\*]
- Magnesium – higher dosing may be useful in migraine, constipation [add 250 mg daily]
- Riboflavin – higher dosing may be useful in migraine [add one B100 tablet a day]
- Vitamin D – higher dosing may be useful depending on blood levels. Most people consider a blood level of the 25 hydroxy of over 30 to be good, there are some papers in autism that suggest it should be higher than 40, but in most cases it should be higher than 30. Unfortunately many laboratories and many physicians consider if it is higher than 20 to be good enough, and that is not really good enough.
- Some providers will want additional supplementation in some patients.

\*The doses above are for an adult. For a child in elementary school it would be approximately half of that to add. And again there is independent variation, based on symptoms.

-Cheat sheet: Add above in an adult to convert from an autism cocktail to a mito-cocktail. Add half of the above in an elementary school-aged child.

### **Slide 39: Adapting SpectrumNeeds™ For Mitochondrial Disease**

This is the go into the nitty gritty, how do I really do this? I'm going to assume that a patient, Johnny is on these supplements on the left hand column, the current receiving in cocktail, the second column, is what he on right now. He is a school aged child between 44 and 88 pounds. So he gets two scoops twice a day, and this is what he is going to get in the middle of the three numbered columns, or the third column starting from the left, that is what SpectrumNeeds gives him. So if you look at the top at alpolypolic acid, he gets 100 mg, BID is twice a day, in SpectrumNeeds he would only get half of that. For instance you could give him another 50 mg twice a day but you can't find 50 mg tablets as well, you can just give him 100 mg once a day, that is fine. So instead of giving him 100 mg twice a day, when you add SpectrumNeeds you would give him only once a day. So it cuts down half of that supplementation.

In CoQ let's say that he was getting 100 mg twice a day. There is a 125 twice a day in SpectrumNeeds, so based on that, you could stop the CoQ completely because he it is getting more. However, is he really getting enough? 100 mg twice a day is really not enough in my experience in most school age children, maybe his blood level is fine, maybe it's not. I would suggest getting a blood level at least two weeks after starting SpectrumNeeds that is high enough and then whether you need to give additional supplementation,

Magnesium, he is on 250 a day and your going to 100 twice a day when you do SpectrumNeeds. Okay so we go from 250 to 200, it is really not that exact. Probably you could stop the supplement. If he has a lot of constipation you would want to consider continuing the magnesium, because he will be on a lot higher and that is really good for that. But for the most part, 250, 200 there isn't really that much of a difference.

The next one here, riboflavin. So he is on 100 mg, he is only getting 25 mg a day on SpectrumNeeds. I would recommend no changes on that, continue the Riboflavin. The difference between 100 and 125 is not significant probably, so you can go ahead and add the SpectrumNeeds and not make any difference.

Ribose, not many people take ribose but some people are and some people it helps. It is not in SpectrumNeeds so you wouldn't make any changes to that when you added it. Vitamin C, he is getting 500 mg a day, SpectrumNeeds will give him 300 mg twice a day. So you can stop the supplement. Vitamin D is going from 1000 mg per day and now you are going to give him 300 twice a day, it really depends, if his Vitamin D levels were sky high probably 300 twice a day is all he needs. If the Vitamin D levels



were just barely high enough, maybe even not higher than 30, then you may want to add SpectrumNeeds and keep the Vitamin D. It really is something that you would have to discuss with your physician.

This kind of gives you an idea, every patient is different, you need to look at what they are getting now, what they are getting on SpectrumNeeds and what kind of symptoms do they have and what is the goal. So here are some ideas on how to adapt it. If you go back a slide, the cheat sheet, I would say as many as half of my patients, I tell them to stay on CoQ and to reduce the alphas, magnesium, and riboflavin in half of what they are currently giving. That seems to be something that works a lot but it won't work for everyone by any means. Again, discuss with your physician,

#### **Slide 40: What Does SpectrumNeeds™ Add for “Mito” Patients?**

Your child might be on 10, 20 different things half of which are in SpectrumNeeds and half of which are different things like probiotics and other issues that are not in SpectrumNeeds. What will this give you? First of all it gives you neuroprotection.

- Neuroprotection: (the patient may or may not be getting these in activated form outside of SpectrumNeeds)
  - Activated B6
  - Activated folate
  - Activated B12
  - Magnesium
  - Zinc

These make patients less likely to have neurological regression, to have episodes in which symptoms increase, particularly neurological symptoms, stroke like episodes, etc, to protect the brain and the nervous system. It can also help in the peripheral nerves it can help with chronic pain and other tingling and other sorts of peripheral neuropathy.

- Additional mito-cocktail: (things that may not be in the mito cocktail)
  - Alpha ketoglutarate
  - Creatine
  - Vitamin B5
  - Selenium

Vitamin B5 is a cofactor, it makes coenzyme A which important in hundreds of metabolic pathways, I consider these to be important elements of the mitochondrial

cocktail at least in many and they are outside of what most people get in the cocktail, because you really can't give 30 things to most kids and you have to take it out somewhere.

- Other

- Comprehensive nutrition
- Arginine (amino acid, helpful with dysautonomia, stroke like episodes, or

POTTS)

- Chromium

The glucose sensor in the blood is in the mitochondria and that is one of the main reasons why patients with mitochondrial disease they get all sorts of sugar problems, sugar goes high, sugar goes low, chromium is important for insulin control and sometimes extra chromium supplementation can help with insulin control. Not in everybody, but it is a trace element and it is in SpectrumNeeds.

### **Slide 41:** Nutritional Support SpectrumNeeds™

#### 33 Active Ingredients

- Promotes mitochondrial energy metabolism.
- Generates essential cofactors, such as coenzyme A.
- Provides strong antioxidant support for free radical removal.
- Removes harmful metabolites, including certain organic acids.
- Enhances methylation needs, and thereby assist in gene regulation.
- Facilitates selected neurotransmission, including GABA receptors.
- Protects the nervous system, including by reducing NMDA glutamate receptor activity.
- Assists in the regulation of insulin control.
- Improves small vessel circulation in the brain. The above claims have not been reviewed by the FDA.

[Buy/learn about SpectrumNeeds™](#)

You can get more information on specific ingredients at the website. You can learn what the literature shows.

[Refer a patient for telemedicine](#)

Question and Answers:

**MaryBeth Hollinger:**

Wow Dr. Boles that was a wonderful and informative presentation. You always inspire and empower us and this time you gave us so much to think about. A few people asked about the dosing. Do you start with a small dose and work your way up, do you just dive right in? When should you expect to see an uptick in symptoms? If no response, do you keep taking it for a few months? What is the exact flavor?

**Dr. Boles:**

That is a really good question and I feel embarrassed that I didn't put that into my talk. Most people just dive into it but I recommend starting small. If your child takes everything without any problem you can just dive into it but if your child is one of those where you start small, in a school aged child you give two scoops twice a day, so start with half a scoop, then go to 1, then 1 ½, then 2. You can go up everyday. It is mostly getting the stomach used to it and the kid used to the taste. If your kid requires longer than that you can do that. But that is what I would recommend in starting, is really knowing your own child on that, you don't need to start off really slow.

For the other question, there are 33 different ingredients and they are going to kick in at different times. I am going to try to make this short but there is almost a caffeine like effect, like if you take one of those energy drinks, I take this twice a day every day at the adult dose, it energizes me, it not only gives me physical energy but mental energy and it helps my mood. The nutrition is important for brain function, there is some of that, people notice that immediately. In terms of what kind of changes can you expect in functional disease, will it help constipation, will it help pain, will it help fatigue, those sort of things, it is going to be on the order of weeks because of the way in which these ingredient work. The nutrition stabilizes and gets rid of some of the toxins, if you will, the reactive oxygen species and the acylcarnitines and it takes time to adapt.

In terms of the learning aspects, about having increased learning, being able to do more things to clear the brain, and try to help that, that is going to take months. That is going to be for anything because let's say you find the magic bullet in your child that completely fixes the genetic problem, well now that brain has to heal itself, and after it heals itself, then your child has to learn. It is just going to take months on that, in particular the antioxidants are very helpful for depression and anxiety in some studies and I have seen that before, but it can take 6-12 months to notice, so it is variable.

**MaryBeth Hollinger:**

Those are great answers and I know many people actually asked those

questions. Did you mention it had a fruity flavor?

**Dr. Boles:**

It has a lot of citrate in it because a lot of the things for the mitochondria are acids and citric acids, in addition to using citrate as a flavor agent, it uses citrate in the kreb cycle. So it is a flavor agent but actually an active ingredient. But there is monk fruit in there, if you put it in water it tastes sort of like lemonade. Most people do take it in water, I take it in juice, it is good in almost any juice, I think the taste is better in that. But it really depends, some people put it in just about anything, theoretically you could put it in tea of mashed potatoes, or in a tube or something like that. Probably better to put it into a G tube instead of J tube due to general absorption, but it is not something that would be made probably.

**MaryBeth Hollinger:**

I don't know if you know about insurance coverage or medical flex plan covering the product? If they cover the components of other products like COQ10 products.

**Dr. Boles:**

Medically it is considered as a food, by the American government. Insurance companies are not going to cover this, or they don't in most cases, but it is really state by state. If your state allows for cofactors it probably would allow for this because this has those cofactors in there. That is why I say state by state, in California, it is no dice here. It is a new product we launched it in March, my own patients were getting it in February and before that it was in the testing phase. It's been only a month and a few days.

**MaryBeth Hollinger:**

I think you are right that different states may feel differently, or have different policies about what is covered. So definitely check your insurance, your state, your policy, see if that little prior authorization helps and go from there.

Another person was asking if any ingredient would be counterproductive for seizures, we also have someone asking, does it mesh well with a keto diet? This person is also asking, there loved one has autoimmune disease of PANDAS. Any experience in those arenas with your product?

**Dr. Boles:**

The product is designed to cause no harm in anybody. Most of the people on this call are sophisticated but most of the people they just have symptoms and they don't know what is causing it. They don't know what their genes are, they don't know what the

name is. This product is designed to cause no harm to anybody regardless of what diet you are on or what you are taking. That is the basic part, a lot of my patients have seizures who are on this. Ketogenic diet is tricky because there is some sugar in this product but there is very little, I actually calculated it for one person. You would have to talk to your nutritionist or your physician about any dietary changes if you are on a ketogenic diet and this would be no exception to that. But it is not contraindicated.

Re: PANDAS question: A lot of my patients have that diagnosis as well as mitochondrial disease, when you go to a PANDAS specialist you get that diagnosed, it is probably both together in some complex way. I don't know of anything in here that would be contraindicated in a PANDAS patient and certainly many of my patients that do have PANDAS are starting to take it, but no results yet.

**MaryBeth Hollinger:**

Is there a discount code available or maybe some smaller samples that could be purchased so that someone doesn't have to buy a large container, although it sounds like you may need the large container to see how your child/you reacts.

**Dr. Boles:**

There are different codes at different times, it is autism awareness week so there is a 10% discount if you go to the site, [neuroneeds.com](http://neuroneeds.com). I am not aware of any other discounts at this time. This is a startup company, with three people and I am one of them and we started up on our checking account, really literally on this, as the orders are coming in we are collecting money to be able to buy these little stick packs, so a stick pack is like a single dose. So we are going to sell those at a low price so that people can try a dose. But we are hoping to have those in by summer, and right now we just don't have those. Because a minimum order is something like 1500 stickpacks, and we need they money on that, just being honest on that. If you want to do it to see if it works you are really going to have to use at least a month so I would recommend buying it. If you want to see if a kid tolerates the taste or whatever, that is an important thing. So far the vast majority of kids have liked the taste. Some physicians are giving a sample of this in their office, one of those jars so they can scoop them out. That is what I do in my office, just to put it in water and see if the kid likes it.

**Stephanie:**

Is it dairy free and gluten free and soy free?

**Dr. Boles:**

It is all of those.

**Jane:**

I'm sorry this is not specifically about these supplements but I am close to you and I was wondering if you could be a resource for me. Have you ever run into any mito patients who have extreme carbohydrates intolerances? Meaning that one blueberry can cause shortness of breath and pain in the body?

**Dr. Boles:**

I have seen intolerance of every type imaginable in patients with mitochondrial disease. I haven't heard one blueberry but food intolerance is very common to have dietary intolerances, sometimes you figure it out, but most of the time we don't.

**Jane:**

I was able to be symptom free for many years because low carbohydrate diet and it wasn't working out anymore and we did a genetic test and I have mito so okay, thank you.

**Joan:**

I have been in contact with Kris, I am on my second trial of the NeuroNeeds and it seems like after 3 days that I have noticed that my ears just ring horribly. You said that there is no copper in the product?

**Dr. Boles:**

Right there is no copper. There is a component, when you increase metabolism and when you increase mitochondrial function and sometimes you will get an increase in certain symptomatology, this product is mostly designed for a younger population, not a lot of adults have taken it yet but tinnitus or ringing in the ears is something that can be part of mitochondrial disease and increased symptomatology may be an issue, so if you have side effects from it I would suggest decreasing the dose or it may be something in there is not working with you.

**Joan:**

Okay because I am already on the Mitospectra.

**Dr. Boles:**

Mitospectra and SpectrumNeeds overlap, Mitospectra has 5 different ingredients, 5 ingredients at high dose, so it may be that one of these is an overdose because you are taking both products together.

**Joan:**

Oh no I wasn't taking both together. I stopped one before I took the other. I do have to add the creatine, what is your thoughts about medium chain triglycerides?

**Dr Boles:**

I certainly have given it to many patients in the past, it depends on the metabolism of the person, many people with mitochondrial disease have problems with fatty acid oxidation and medium chain triglycerides can be damaging to them. I would defer to the individual physician to determine if it is safe in each patient.

**MaryBeth Hollinger:**

Thank you so much for your time I know you have a busy office waiting for you, and for our community if you have any follow up questions you can reach out to me. I can't thank you enough Dr. Boles. Everyone you should know that next months lecture is about navigating that medical system and keeping safe with indications of medical child abuse and things that go along with that. So keep your ears open, Dr. Boles is gracing us again with his awesome knowledge and presence to explore that topic as well. Dr. Boles, a very heartfelt thank you.