

# ADHD Family Summit

Bringing Your Family Into Focus



## The Ear-Brain Connection: The Role Of Auditory Processing In Attention

With Alex Doman



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## The Ear-Brain Connection: The Role Of Auditory Processing In Attention

With Alex Doman

**Dr. Rory Stern:** Hello and welcome everyone. This is Dr. Rory Stern of [www.ADHDFamilyOnline.com](http://www.ADHDFamilyOnline.com), your host, and organizer for the ADHD Family Summit. I'm very excited to be talking tonight about a topic that I mentioned earlier. This is a pre-recording; I will be a hungry listener, learner, attendee, and note taker along with the rest of you.

I've had the pleasure of getting to know our guest. I've known him almost a year now.

This is going to be a very exciting topic; one that deals with things "looking" like ADHD or co-occurring with ADHD. It can really make the art of getting the diagnosis right that much more important.

Before I introduced tonight's topic and guest, let me just thank our sponsor and remind all of you about CogMed Working Memory Training. CogMed Working Memory Training is a proven software-based program designed for sustainably improved attention. Eighty percent of participants significantly improve their ability to concentrate and use problem solving skills after training.

I will also remind you that CogMed has prepared a special page for attendees and guests of the ADHD Family Summit.



You can learn more about CogMed and what their system has to offer by visiting [www.ADHDFamilySummit-CogMed.com](http://www.ADHDFamilySummit-CogMed.com).

Tonight's topic is called "The Ear-Brain Connection: The Role of Auditory Processing in Attention."

Our guest tonight is Alex Doman. As always, I will read a little bit about our guest and then introduce him. We'll see where we go from there in terms of what I may have overlooked – any pieces of what's important for tonight.

Alex Doman is the Founder and CEO of Advanced Brain Technologies, a neurotechnology company that develops and distributes interactive software and music programs for the improvement of memory, attention, listening, academic skills, sensory processing, brain health, peak performance, and more.

Alex is the third generation of a pioneering family of neurodevelopmental specialists working with pediatric and adult populations since the 1940's. Prior to founding ABT he served as Executive Director of the National Academy for Child Development.

For the last 15 years his career has been focused on research, product development, and education primarily in the areas of psychoacoustic music technologies and brain fitness software. Alex leads the international multidisciplinary team who is responsible for creating all ABT products including the Music-Based Auditory



Stimulation™ method The Listening Program® together with other music programs; SoundHealth®, Music for Babies™, iListen™ and Spatial Surround® HD. Further products include BrainBuilder®, an interactive brain fitness software program.

Alex has developed curriculum for and trained thousands of health, therapeutic, education, and music professionals as Providers of The Listening Program®. He is a frequent invited lecturer at international conferences and his work is regularly covered by the press. Alex is a music producer, writer, and inventor with patents pending on methods to improve auditory processing, spatial awareness and apparatus and method for transmitting auditory bone conduction.

However, more importantly, Alex is a huge Metallica fan and loves to have fun playing his brand new Guitar Hero Metallica.

Welcome Alex.

**Alex Doman:** Thank you, Rory.

[Laughter]

**Dr. Stern:** With that intro, including the little ad-lib at the end, is there anything I missed about your background that might be relevant to share with our audience tonight?



**Alex:** One of the things that I'll share is that I'm one of the kids that we frequently speak about. If the diagnosis had been around when I was a child, I would have been diagnosed with an Auditory Processing Disorder. I would have likely fallen into some of the symptomatic criteria for ADHD.

**Dr. Stern:** Please tell me a little bit more about that. I was going to ask if we could start there because that's something that we talked about months ago when we were organizing this Summit.

You were identified as a certain type of student. If I remember correctly, you didn't get that label, or fall into that group, for a certain reason. Can you talk a little bit about that?

**Alex:** As a child in school, I was one of the kids that were highly distractible. My distractibility was primarily caused by my being distracted by background noises in the class room. It made it very difficult for me to attend.

As a result, I was one of your more difficult kids to manage behaviorally in the class room. I struggled with the attention, challenged teachers, and made them work for a living.

I never did receive a formal diagnosis in school. I did struggle with listening, learning, and with attention. It wasn't until adulthood that I was able to begin to work on some of the symptoms that I was experiencing; they really gave me challenges in school.



**Dr. Stern:** That's fascinating; I appreciate you sharing that. I think it's important for families to hear that they're not alone and that very successful people – people identified as “difficult” – when they have the right supports, get the right information, and when they carve their own path in a certain way, while also navigating the system, can be successful.

**Alex:** Absolutely.

**Dr. Stern:** Let's talk a little bit as an introduction. Normally I have more of a formal outline that people can open up. However, as I hinted, we're wide open tonight. This is a very important topic; but, I don't know much about it. I'm hungry to learn about it.

Let's talk right away. What is Auditory Processing Disorder?

**Alex:** Before we talk about Auditory Processing Disorder, I think it's important to define “auditory processing.” This is what the brain does with what it hears.

For somebody to have an Auditory Processing Disorder, it means that the information being processed in the brain, relative to the auditory world, isn't being clearly understood. That leads to language, communication, social, attention, and behavioral issues for the people that are suffering with those symptoms.





The diagnosis is one that is made by an audiologist. First there is a symptom profile. This looks very similar to an ADHD profile in terms of the symptomatic listing.

However, an audiologist will then take a child or adult, age seven or older, through a very specific audiometric battery of tests to identify an Auditory Processing Disorder and to make that diagnosis.

**Dr. Stern:** Okay; those are some very key points. I'm very happy you started with the definition of "auditory processing."

Please tell me a little bit about some fundamentals, Alex; about how our brain and the whole system works in terms of taking in information and processing it.

**Alex:** As you, Rory, and many of our listeners tonight are well aware of, we are sensory processing beings. Our senses take in information through sight, sound, touch, taste, smell, and body movement.

Auditory processing is an important form of our sensory processing. It allows us to take in the information from our world. Information about language, sounds, body location within space, and gives us the ability to understand that information and act and respond to that information.

One of the important parts about auditory processing is its simple role in our basic survival. Our ear and brain work together to monitor our world and to assess whether or not



we're safe in our environment. It plays a very important role in our fight/flight survival skills.

That's one of the points that I want to talk about tonight; people that have sensitivities to sound, or sound is painful or uncomfortable to them, are constantly monitoring their environment for safety. They aren't in a ready learning attentional state. For children with this challenge, it leads to a lot of class room problems.

**Dr. Stern:** That's very interesting.

To draw a parallel for a minute, that has a lot to do with how it looks like distraction or distractibility in attention, correct?

**Alex:** Absolutely.

**Dr. Stern:** Let's step back and slow down before we get into Auditory Processing Disorder. Maybe this is a good time to look at the parallels of auditory processing and ADHD. Then we can get into what the disorder is. Does that work for you?

**Alex:** Yes, absolutely.

When we look at ADHD and Auditory Processing Disorder (APD), what we have to understand is that often these are co-existing conditions. There are a very high percentage of children diagnosed with ADHD that are also suspected to have APD.



What also happens is that the children often go undiagnosed or misdiagnosed. However, what may be a true Auditory Processing Disorder is never diagnosed because the referral isn't made to an audiologist; it's treated as ADHD.

When it's treated as ADHD, especially with medication, that's a case where the individual may be non-responsive to intervention; that's where the proper diagnosis is important.

However, that proper diagnosis is tricky. When we look at the symptoms of APD, one of the common symptoms is difficulty blocking out background noise; but, to the teacher in the class room, that looks like inattention.

That inattention just happens to be caused because the brain isn't filtering out the background noise as it should be doing automatically. It's then directing the attention to a conscious act of trying to filter that out and focus on what the student should be focusing on.

With Auditory Processing Disorder there's a difficulty following conversation. Typically people with APD are fidgety and very distractible. They have problems following directions, especially multi-step directions that require sequencing.

Their organizational skills are poor. We see problems with auditory working memory. They have difficulty



understanding instructions, or following conversations and being able to have a two-way dialog.

We also see that transfer over into some language disorders where the child with APD may have difficulty with expressive language. We'll see challenges with reading performance, overall academic performance, as well as the challenge with peer relationships.

All told, we then end up with a child that tends to have fairly low self-esteem; their self-confidence is low because they're not achieving with their peers. It's a lot like ADHD.

**Dr. Stern:** There's one other thing that's jumping out at me. I'd like to get your take on it. I'm sensing that there's also some difficulty with social skills. I'm basing this on the communication and reading situations. Is that a fair conclusion to draw?

**Alex:** Yes, absolutely.

When you have an attentional problem you don't pick up on all the information that you need to dialog with somebody. So in addition to the problems with the receptive language and the processing of that language in working memory in order to respond to a conversation, generally there's a difficulty picking up the non-verbal cues that we need to really understand what someone is saying.

Another piece of the APD is a problem with a skill called auditory cohesion. Auditory cohesion is the ability to take



the meaning or the abstraction from language. Those intonations in the voice that give us cues about the information that someone is delivering to us are generally lost or not understood.

**Dr. Stern:** Unbelievable. My mind is going back towards the overlap and co-existing. Do you have numbers or could you take an educated guess on what the percentage is with APD and ADHD together?

**Alex:** Without citing specific references, I have seen numbers that are as high as 50 percent of kids with ADHD are also believed to have an auditory processing deficit.

Looking at the general population, estimates conservatively range from three percent to an aggressive estimate of 20 percent of all students.

**Dr. Stern:** Wow; all right. Let's talk about some basic things that might be important when trying to conceptualize the basics. How long has APD been around, either in the literature or as we understand it today according to Diagnostic and Statistical Manual (DSM) diagnostics?

**Alex:** Interestingly, APD has been understood and identified as early as the 60s and 70s.

One of the pioneers in the field was Dr. Jack Katz. He made the definition of what the brain does with what ear is being auditory processing.



However, it's still not widely known, especially among professionals and educators. It is not in the DSM for criteria. That is one of the challenges, much like Sensory Processing Disorder which also has yet to make a DSM criterion for absolute diagnosis. That's one of the problems.

There's a big movement to create awareness of what APD is, or CAPD, which it is also called. CAPD is Central Auditory Processing Disorder.

**Dr. Stern:** That's fascinating.

We're going to go off topic for a second; but, can you speak at all about ear infections. Is that an early indicator or does that play any role in what might later become APD?

**Alex:** This is a greatly debated area. However, it's actually what we believe was the cause of my own auditory processing issues.

Using myself as a case study – I had chronic ear infections as a child. I also had a couple of sets of ear tubes. That predisposed my system to sensitivity to environmental noise and sound.

Commonly people do accept that early ear infections can be a cause of APD. Other causes are hereditary factors, toxic noise exposure, sensory deprivation – we see a lot of this in children who are adopted from orphanages.



There are also issues related to a mal-formation of the corpus callosum, which is that bundle of nerve fibers that connects the left and the right brain hemispheres to one another.

Brain injury also can play a role.

However, colleagues that I work with and I believe that ear infections are probably one of the number one risk factors for APD.

**Dr. Stern:** This is very, very interesting stuff. I also asked that because there's recent talk, or debate, if you will, from conversations on [www.Twitter.com](http://www.Twitter.com), believe it or not, about whether or not and to what degree ear infections or listening difficulties are indicators of ADHD.

**Alex:** I think it's important to look at what an ear infection does to understand the impact on the brain.

When an ear infection occurs, if fluid backs up into the middle ear, at that moment that individual has a temporary hearing loss of 20 to 40 decibels. That's enough to qualify for a diagnosis of a hearing loss with an audiologist.

Even though it's mild, what's happening, especially in the early years, is the brain is being deprived of the sensory input that it needs to lay down a pathway, or the pathways, of auditory information processing.



It's getting distorted, incorrect information whenever that ear infection is present and sending bad data to the brain to lay down the wiring for a lifetime of processing auditory information.

It's a very difficult argument to make that it does *not* play a role.

**Dr. Stern:** That's very interesting.

There are many different directions to go. However, what I think would be important would be to now bring this back to the focus on auditory processing.

If I'm looking at things properly, we have a good foundation. Have we touched upon anything yet of the difference between hearing and listening?

**Alex:** Thank you for bringing that up, Rory. I think that it's important to understand that there is a difference.

Hearing is the passive ability to sense sound.

Then we have a skill called "listening." This is the dynamic, conscious ability where the brain is tuning out what's not important in our environment and tuning into what is important.

The brain cannot process and devote attention to everything going on around it. It does have to selectively decide, "This isn't important; this is what is important." In





the skill of listening, that's what we do with auditory information.

When we combine our hearing and listening abilities, we get into the role of auditory processing which means the brain is using that information that we are bringing in.

I think another important point to bring in is that often parents ask, "When my child has an Auditory Processing Disorder, is their hearing okay?"

There is generally no problem with hearing acuity. The hearing acuity is fine. However, the brain is getting mixed messages and not processing the information coming through the auditory system.

**Dr. Stern:** I'm almost speechless, Alex. There is just so much to know. When we look at the simple diagnostic process that so many people have become familiar with in terms of, "You get a report from a teacher, co-worker, or loved one; you go see a doctor. In many cases, it's a very short visit; there are a couple of questions. 'Here's your diagnosis and prescription. You might want to see a therapist.' You're on your way."

Yet we're uncovering so many things that really play a central role to what might really be going on.

**Alex:** Absolutely.



**Dr. Stern:** If I'm following along with you, what are five auditory skills for optimal learning?

**Alex:** When we look at the learning process, in terms of the auditory system, first of all we have auditory attention. The brain has to be able to attend and register the auditory information coming to it.

Secondly, we have to discriminate the information to be able to tell the differences or the likenesses of the sounds and the words that are being processed through the brain.

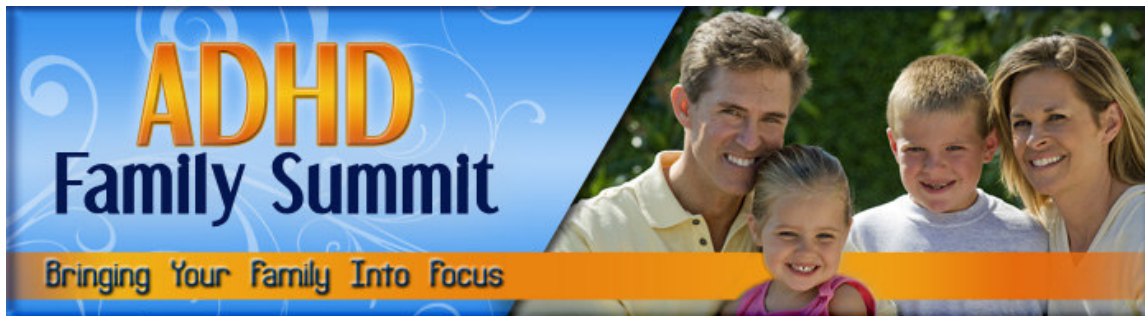
Third is the skill of auditory figure-ground. That is that filtering process where the brain is tuning out what's in the environment and tuning into what we need to be attending to.

A fourth skill would be temporal processing. That would be the timing of the sounds.

I want to give you a quick example of that because the timing of auditory processing is absolutely critical.

If I say to you, "Rory, I live in a greenhouse." Versus, "Rory, I live in a green house." The two have totally different meanings. Either my house that I live in is filled with plants and it is made of glass; or, my house is painted green.

Those timing differences in the sound are absolutely critical to understanding spoken language.



The fifth is auditory memory. It's the ability to receive, store, process, express, or utilize the auditory information that's coming into the brain.

**Dr. Stern:** At what point during the process when you recognize inattention and distractibility, at what point do you recommend to families that, "This needs to be considered. Maybe you need to see an audiologist."

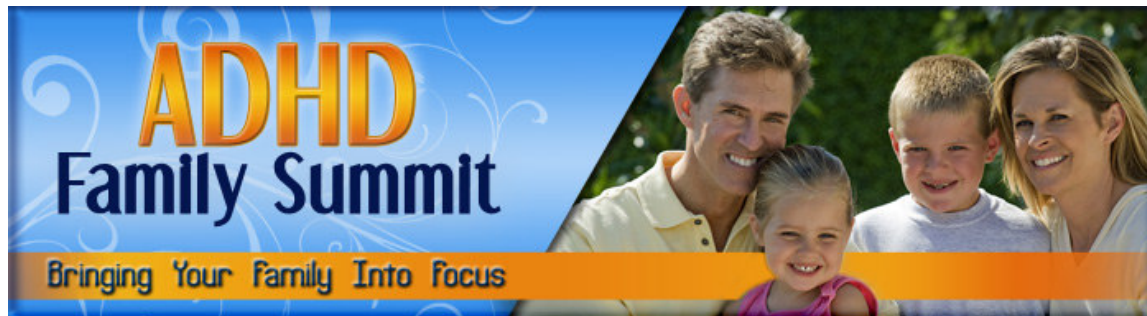
**Alex:** At present, audiologists are the only ones to make the diagnoses. However, if the family has access to a speech-language pathologist, they are generally well trained and qualified to screen an Auditory Processing Disorder.

There are screening tests that are done. Many are made available through the school system.

If a parent suspects an Auditory Processing Disorder, they may request if a screening could be done for APD by the school or to go to a private therapist for that.

However, for a formal diagnosis they would need a referral to an audiologist.

**Dr. Stern:** I'm biased because I'm in my practice; but, a lot of what I hear when people come in is the inattention, hyperactivity, fidgeting, getting in trouble, and not completing school work. In adults it's having a difficult time in the workplace, getting things done, being a self-starter...at what point should people start thinking, "Okay, sure it could be ADHD. However, something else is going on."



Are there key differentiations that suggest APD is more of what's at stake?

**Alex:**

One to look at is, "Do the behaviors change in the environment?" This also happens in ADHD. However, does the child perform better in a quiet environment? That's one thing to look for.

If they do, the chance of the Auditory Processing Disorder or Deficit may be lower.

If the child has a problem screening out background noise then we really want to look toward APD.

If they comment that they are "sensitive" to certain sounds – or even that some sounds cause them pain or discomfort – that's another reason to look at the APD.

It's not to say that kids with ADHD can't have hyperacusis or sound sensitivity; but, in APD that is actually quite common. That's another particular one to look for.

In addition, in conversation, does the child have a problem picking up the nuances and subtleties within the word? This means that they're attending and focused but are not getting the meaning.

You also need to look at it in their expressive language. Our expressive language is a mirror of how the brain is



interpreting the auditory world. We can only reproduce what the brain can hear from the outside world.

If we see some challenges with expressive language, blending of words or the end of words dropping off, then that is also something to look at. It could be APD or a language based deficit.

Those are some of the things that we look at. Another thing would be if there's a history of ear infections in childhood; that would be another indicator of APD.

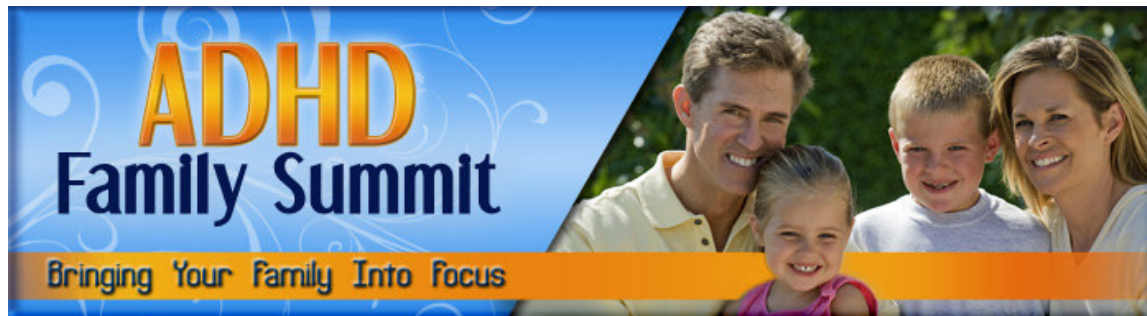
**Dr. Stern:** Again, I'm speechless because so much of this overlaps. It's incredible how through all of my training to become a therapist and then a coach, that there's very little talk about APD.

**Alex:** There needs to be a lot more of it. This is really in the domain of audiology and speech language pathology.

The American Speech and Hearing Association, which has oversight over both disciplines, have really put this into the domain of the audiologist.

The audiologist has classically done hearing screenings, looked for hearing loss, and provided treatment interventions for that.

However, in terms of intervention for Auditory Processing Disorder, pretty much what are available are accommodation strategies to work around the symptoms.



Until we get more sophisticated in early identification, and do more general professional awareness such as psychologists that are evaluating children every day, we've got a long road ahead.

**Dr. Stern:**

I agree; again, with my personal bias, I'll say, "This is yet another argument or reason why I think it's more critical than ever for people to be paying attention to the behaviors, their observations, asking questions, paying attention to the context and environment of what they're seeing and not just getting wrapped up in, 'Is it ADHD? Is it not ADHD?'"

Unfortunately there are biases depending on what professional you see and who you have access to.

You said it very well earlier, Alex. You need to have a right diagnosis for the right treatment.

However, at the same time, in my opinion, you do need to be aware of what's going on.

**Alex:**

Absolutely; for treatment, "Yes" on diagnosis in terms of the individual. I'm not a big fan of labeling; not a big believer in slapping a label on somebody and branding them as "this."

When we brand somebody as APD or ADHD, we are then imposing our self-limiting beliefs on what they are capable of doing. This is the last thing that we want to do in our



work. What we want to do is empower people with information, to know where to go, and to treat the cause rather than just put a Band-Aid on the symptoms.

Unfortunately, we're heavily into Band-Aids in our society. We don't want to be; but, that's the nature of where we are.

**Dr. Stern:** I'm going to drill you a little bit more on this because that's a very powerful statement.

I know what you mean. However, I want to make sure it's clear to everybody.

What do you mean by a "Band-Aid society"?

**Alex:** By a Band-Aid society, we are looking for symptom treatment. We very rarely look at the cause of those symptoms because that's more difficult and less understood.

It is easier to take a pill. It is easier to drop a child off to a therapist rather than to work with your own child and treat them. It is easier to say, "It's the school's responsibility and not mine."

I feel very strongly about this. Parents need to take a very active, dynamic role in their children's development.

The professionals need to support, empower, and educate them in absolutely every way possible.



However, I've been down this road with my own step-sons with their own symptomatic challenges of working to find a diagnoses just to find that the diagnoses doesn't provide us any information for treatment. I've been there and lived this. A diagnosis hasn't given us an answer; it's given us a label.

Even as familiar as I am with this field and helping children, that label makes you begin to look at your child a little bit differently; and, not necessarily in a positive way.

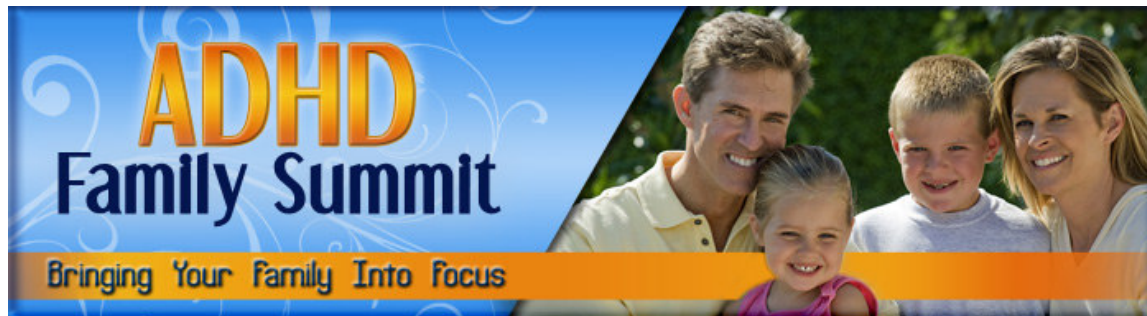
**Dr. Stern:** Those were two incredibly powerful statements. Number one was talking about what it means to use a "Band-Aid" approach. This is why we're doing informational calls like this to talk about, "What's going on? What are you paying attention to? What else might be going on?"

And then secondly, certainly the change in perspective, I think, is very common. That's another discussion for another day. However, thank you for addressing that.

Let's try to get back on track. I know that you have a lot of information to share. What makes the most sense to pick up and run with right now, Alex?

**Alex:** I think, in terms to understand a little bit about how the auditory system works, its role in our life, and the connection with the brain, generally people may not have a lot of exposure to understand the role the ear and brain really have in our function.





If you'll allow me a few minutes to touch there, I think that that would be helpful.

**Dr. Stern:** Please.

**Alex:** First of all, I think it's important to understand that the auditory system is the only sensory system to be fully functioning in utero. At 16 to 20 weeks of gestation, the fetus is processing auditory information; it's responding to the movement of the mother's voice.

The inner ear is developing; the auditory pathways are the first to begin mylenating.

The auditory system is very core and fundamental in the overall development of the brain. Just from a developmental standpoint, we have to look at the importance that that plays within our lives.

Secondly, we need to understand that the ear is connected to virtually every organ in the human body as well as to other areas, including the vision system.

The auditory system incorporates the balance system that regulates our posture and verticality in our world; in our proprioception, our sense of touch and integrated muscle joint movement.

When we look at the ear we have to understand that the ear is not only the organ that allows us to have a



conversation with somebody; but, it's also the organ that allows us to walk upright, use our vision, and to ride a bike. It is a fully inclusive system that connects with all of our other sensory systems.

In this development we have to understand that early exposure, just like in all the sensory systems, is absolutely critical. It's important to have exposure to good sound and music; and, to have limited exposure to noise.

There is research done by Dr. Michael Marcenik, a neuroscientist in San Francisco. He's done intensive research looking at the impact of our environment on auditory development. He's actually shown in lab studies that toxic noise creates a negative impact on the brain; it actually slows down and prohibits the development of auditory connections where good, well-structured sound actually facilitates the development of connections within the brain.

So for parents to look at the exposure of an infant, toddler, and even the mother prenatally, to their auditory world and understand that that's setting up the foundation for the rest of their life.

Our auditory system is a critical component in receptive and expressive language; vision integration; and balance. We use it in our daily lives for all of our interactions; it's the key to communication.

I think this is really, really key for us to understand.



I'd also like to take a couple of minutes to go through a checklist of auditory processing symptoms. It might be helpful for some of our listeners to help them to recognize if there's an auditory deficit.

Do you think this would be useful?

**Dr. Stern:** Yes, absolutely.

**Alex:** When we're looking at this, "Does a child or adult have difficulty listening and paying attention?" Or, "Do they misunderstand spoken information, directions, or questions?"

If they ask a lot of "Huh?" or "What?" you may have a problem.

If people require having directions or information repeated over and over again; or can only retain the information if you write the instruction down, that's very key.

If they have problems with multi-step directions, "Johnny go to your room to your sock drawer and pull out your blue socks; put on your Vans tennis shoes, come down, and we're going to go to dinner."

Later you go up and find Johnny in his bedroom not knowing why he's there. That's a good example that something is going wrong.



The distractibility, background noise, pain or discomfort with some sounds, or problems understanding the similarities or differences in sound; phonics problems is another one and key to look at - when kids are struggling to read through a phonemic method of reading instruction.

Also an inability to identify where sound is in space....when a sound happens, the child doesn't respond to it appropriately or understand where it came from; or, in some cases, even if the sound occurred in their environment.

Those are some things to be looking toward.

**Dr. Stern:** Once again, there's a lot of overlap.....so many overlaps in what we know and understand about ADHD.

**Alex:** Yes, auditory working memory piece is a real big commonality that we see between APD and ADHD. This is where the working memory deficits are parallel in both situations. So the question is, "How big of a role does that actually play in both conditions?"

I think it's quite significant. Probably the biggest link between ADHD and APD are these auditory working memory deficits.

**Dr. Stern:** I'm going to be a broken record. However, I really am still just struck that this is the first I'm hearing a lot of this. There is just tremendous overlap and accountability for what so many people can be struggling with.



I'm even looking at a slide from one of your presentations for "other signs of difficulty." Can you run through that? I think that's another key list to be aware of.

**Alex:**

If we look at problems with oral expression, meaning that the kids have a hard time expressing what they have in their head, putting that information, articulating it clearly, and being able to form and express the concept.....if you get a lot of "Ummms" and a lot of stalls in that language, we're seeing that auditory working memory deficit.

This is because it's a stall trying to figure out what we're going to say next.

That's really important to look at.

The ability to "get" concepts – when you explain something to somebody, can they get that; can they think in words or do they have to see a picture to have a concrete understanding of what's being shared with them?

The problems with the phonological awareness that we spoke about; these are primarily timing issues – an issue of the brain understanding the timing of the language as well as the frequency or the sound content within the language.

We see issues with word finding and retrieval. This goes to that oral expression idea.



Then we see the problems with reading comprehension because we do read with our ears. Even though we read with our eyes, we're processing and translating the words off of the written page with our auditory system to understand and retain that information.

Then there are the memory aspects; if people aren't taking in the information and understanding what's being conveyed to them, we'll see a lot of behavioral issues. These were some of the challenges that I had as a kid.

You do not really understand what's going on so your response to the situation may be inaccurate; you're not reading it right. Therefore your response is wrong.

I'm sure you've had this experience, Rory, and I have with my wife. "Here we go," right?

[Laughter]

She'll say something to you, or you'll say something to her. You can repeat it back verbatim. However, the other person swears you have no understanding of what they just said.

**Dr. Stern:** Uh-huh.

**Alex:** That's an auditory cohesion problem. "I'm just not getting what you're saying even though I can repeat it back word-for-word." The brain isn't processing it.



A really important key here is to look at the factor of stress. Stress plays a huge role in impacting all of our cognitive function, especially attention, as you know, and auditory processing.

If we're in a stressed state, our systems are not functioning optimally; we are closer to a survival mode when we're in stress. Our cognitive functions are greatly diminished in those cases.

**Dr. Stern:** You mentioned that earlier – you wanted to talk about “fight or flight.” Is that what you're starting to refer to now?

**Alex:** It is; it is.

I think this is a real central point to focus on. It's something that we see not only in auditory processing deficits but very commonly in Autism Spectrum Disorders.

As we see a lot of auditory processing deficits in ADHD; we also see this in the autism spectrum. It's not mutually exclusive; a parallel with ADHD.

We also see it in diagnoses of Dyslexia, Learning Disabilities, Autism Spectrum Disorders, et cetera.

This fight/flight piece is important to attune to.

The auditory system normally is scanning the environment. It's scanning the environment to decide whether or not



we're safe. That is the first and primary role of audition; to monitor our environment for safety.

There's a part of the ear which is very critical in this function; it's the middle ear.

I'll explain that briefly. There are three divisions of the ear – the outer ear, which is the ear that you see; the auditory canal; and the ear drum.

Sound waves, from language for example, reach that ear; go down to the ear drum and the ear drum moves. It moves some little bones that are within the middle ear, translates the sound to the cochlea, and then auditory neurons are stimulated. They send electrical signals to the brain and then we consciously recognize sound.

I want to focus on the middle ear piece. Within the middle ear, you have these three bones, which are the ossicles we learned about in school – the hammer, anvil, and stirrup.

However, there are also two muscles. These are the smallest muscles in our body called the tensor tympani and the stapedius muscles. These are an important part of our fight/flight mechanism.

Primarily the middle ear blocks out sound, especially low frequency, loud sounds that could damage the delicate cells of the inner ear.





At the same time, it is attuning or amplifying the volume of sound within speech so that we can communicate with one another.

That's where that skill of auditory figure-ground that I mentioned earlier is quite critical. This is because the brain and the ear will simultaneously block out or dampen environmental noise and attune into language so that we can carry on a conversation with somebody in a noisy environment; for instance, a class room or cafeteria, et cetera.

There has been research that's been done to show that if somebody is in a stressed state, or in a state of anxiety, the middle ear ceases to perform its role of dampening noise and discriminating language. That is because it's part of our survival mechanism.

If we are under threat, it isn't necessary to block out those sounds, or to attune into language. It is necessary to decide whether or not we fight or whether or not we flee.

This system switches off when we're stressed or anxious, even if we're not compromised and actually unsafe; there's a false signal, if you will, that goes to the brain. It makes us think we're unsafe even though we are safe.

Many with the hyper-sensitivities to sound experience this on a constant basis. That was true with me.



The system is shut off or switched off, if you will. Then our energies are devoted elsewhere; that is, trying to feel safe or comfortable in the environment.

**Dr. Stern:** That's remarkable.

One of the core principles of what I do in my work, and how many of my colleagues have been trained, is that with kids you need to provide safety for them.

When mentioning stress and anxiety – this system can shut down and lead to behavioral problems. My goodness that just captures so much of what we see and deal with everyday. I'll also go out on a limb and say that maybe that's even been overlooked for many people.

**Alex:** If we're not safe, we can't attend; because we're not supposed to.

**Dr. Stern:** Yes, absolutely.

On a theoretical level, or an observational level, it makes sense. However, I feel like there are all these "Ah-ha" moments. Again, I'm a listener tonight, Alex.

I'm having one of those "Ah-ha" moments saying, "Okay, so now it's just not enough that we see it; now I understand 'why' this constant state of stress, anxiety, lashing out, et cetera. "

It can be explained just from what you described.



**Alex:** What you're essentially saying is that you have one of your sensory channels constantly open; not filtering stimulus.

The auditory system is open when we're stressed or anxious, or in that survival state, whether we recognize it or not. The filtering mechanism is broken and the auditory system is being bombarded with stimulus; and it's more stimulus than the brain can filter and modulate. Then we see the behavioral problems in response to that.

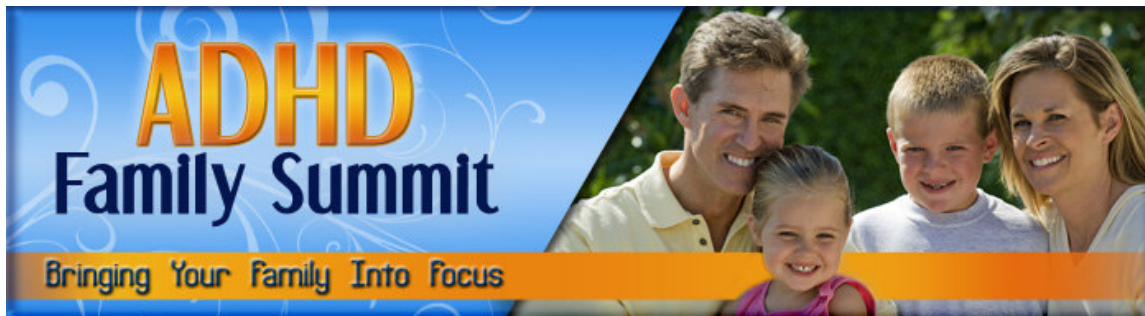
It's just as if I gave you too much visual input; too much touch input. You reach a point of sensory overload. If that happens, the auditory system does one of three things. It shuts down.

We see kids literally just tune out and tune off from what's happening in the environment because it is a survival mechanism.

The other – which I did more commonly – is that you act out. You flee the situation; and, in fact, may engage in behaviors that remove you from the situation to get to a place where you can be less stressed or relaxed.

A lot of kids are subconsciously engaging in behaviors that are going to remove them from that place they don't want to be – where they're stressed or overloaded.

That's an important one.



As I mentioned, the absolute shut-down. They try to escape the situation; they engage in a behavior that's going to remove them from the situation; or they just shut down and tune out; there's no attention.

**Dr. Stern:** I'm going to jump for a second because I'm aware of the time. I know there are a few more points that we need to get to.

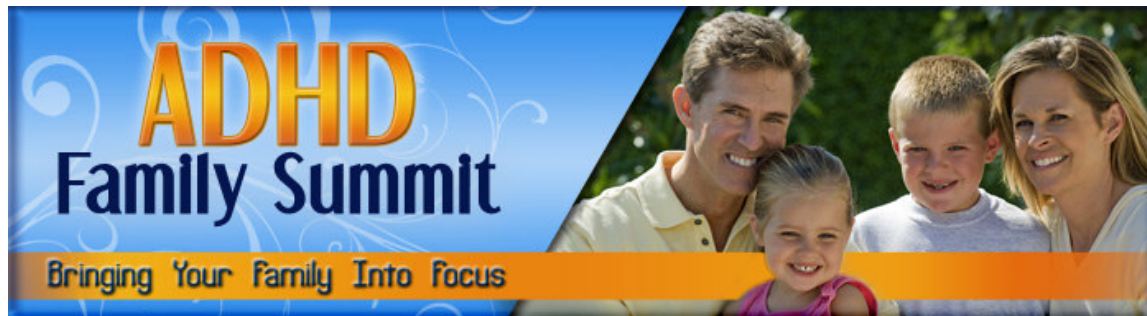
However, one thing that I can't grasp enough of – you mentioned reading comprehension. Can you please tell me a little more of some of the difficulties, because of the auditory processing, affect reading comprehension?

**Alex:** For reading comprehension to occur, we have to take in the visual symbols of words. Then we have to translate those symbols into language using the auditory system.

One aspect of this that's important is "frequency discrimination."

Let me go back – there are four building blocks to auditory processing, Rory. There's the ability to distinguish or discriminate frequencies or the tone of sound; the volume or intensity of sound; the timing of sound; and, then, the location of sound.

What are really critical with reading comprehension are frequency and the timing.



If we don't understand the frequency discrimination and the blends in the words – for instance, the difference between “bah” and “dah,” that would be one example.

However, we also need to sequence that information. We have to sequence the sounds within the word; then sequence the words within a sentence; sequence the sentence within a paragraph; and then to the context of what we're reading.

With an auditory processing deficit, there may be no problem reading the words and understanding what they are. However, you can't sequence them together and hold them together to take meaning and understand what you just read. It just breaks down. That's a big role in the auditory working memory.

**Dr. Stern:** That's very helpful; I'm asking for a number of reasons.

I'm going to jump again because we have some other really critical points to get to. That, however, was just something that was stuck in my brain.

Let's take a minute or two to briefly touch upon auditory working memory.

We're going to have an entire call devoted to working memory. However, I know that this is important.



I would like to try and finish up with, “What are some of the things that you can do?” and, of course, your experience with The Listening Program® and music.

Let’s start back, again, with auditory working memory. How does the whole system work that way?

**Alex:** Auditory working memory is the brain’s ability to receive, store, process, and utilize information.

We need to think of it as our “mental scratch pad.”

If someone says a phone number, we should be able to take in that phone number, retain it, and be able to repeat it back.

If we’re not able to do that, that memory that we rely on to process language and reading, for example, is at a deficit.

We need to be able to hold a certain amount of information in that memory. If we’re not able to, then there’s a working memory deficit.

**Dr. Stern:** Okay; tell me a little bit more about that.

**Alex:** Working memory deficits, as you’re well aware, are really common in ADHD. We also see it in CAPD.

My family has been involved with researching auditory working memory and visual working memory for over 30



years in a caseload ranging from severe brain injury to highly gifted function.

What we've recognized is that this memory develops at the rate of approximately one unit of information per year from birth to age seven. Then at about age seven, we reach a maturity, if you will, of capacity in that auditory working memory ability.

What's happened over recent decades has been what appears to be a decline in auditory working memory and a slight improvement in visual working memory. I think this is a reflection of our environment and the stimulus that's within our environment.

However, if you can't take in, store, or process the information being spoken to you right now, for example; so as I'm speaking you're using your auditory working memory to take in the words; hold them in, in order; think about how you're going to respond; and then be able to respond.

The longer that I talk the more auditory working memory you're going to need to use in order to respond to me.

In ADHD and in CAPD, we generally see a deficit below the norm. With that, then, the brain is just not getting the information it needs to respond to what's around it.

**Dr. Stern:** Okay, excellent.



I know that many people have been waiting for this moment; this also includes me.

What are some things that people can do when auditory processing is a challenge?

**Alex:**

Well, depending on what you're seeing is a deficit, that's the first important point to look at.

However, you start with accommodation strategies. I'm not big on accommodation; but, we'll start there.

First of all, in the class room the teaching environment should be modified for a child with an auditory processing deficit. They're going to need more written instruction. When they're spoken to they're going to need to be able to look the teacher in the face and be spoken to directly in order to take in that information better.

In all circumstances possible, they need to have the background noise minimized. The study environment for the child with APD is very important.

When home, the kids are not studying where there are a lot of distractions going on. The family kitchen or great room is generally not the right place; they need a good quiet place where they can focus.

Baroque music can also be played very softly in the background. It has a tempo, rhythm, and frequency





structure to it that helps facilitate better attention. It will help filter out some of the background noise.

In some cases, even a personal FM System can be used in the class room. This is where the teacher speaks into a microphone that gives a direct input to the child. Or, even class rooms can be outfitted with sound systems so that all of the children in the class room hear the teacher at equal volume. That can be very helpful.

Environment, more written instructions, less verbal instructions – those are some of the accommodation-type strategies.

In terms of treating what's wrong, we have to train the brain how to process frequency, volume, time, and location of sounds.

The way that we train the brain is through experience and exposure repeatedly to the right information at sufficient frequency, intensity, and duration.

That's what we use methods like The Listening Program® to do; to use music that has all of the elements of auditory information to enhance that music through the way that we record it. We produce it in the studio and actually take these elements to train the brain's ability to perceive them with more accuracy.

This is because it's music – beautiful classical music – the brain wants to attend to it; the child wants to listen, too.



It's interesting and novel; it resonates with the way the brain processes its environment.

We simply make a very specialized music program that helps train the brain with those foundations of auditory processing.

**Dr. Stern:** Okay, I want to ask an obvious question. You made an interesting comment, "I don't like accommodations; but, I'll start there."

Explain that a little bit more.

**Alex:** To truly intervene with an Auditory Processing Disorder is going to be a fairly significant commitment of time for a family to do. It's not something that can be changed overnight.

We start by modifying the environment to provide some relief and to help prevent further problems from occurring.

We want to give somebody the ability to improve their function; and by modifying their environment, giving them some good background music, and decreasing the noise in the environment, they're going to cope better with the deficit.

It's not going to change what's happening in the brain; it's not going to fix the problem. To fix the problem, we have to intervene.



**Dr. Stern:** That was the answer that I was hoping you were going to give. I don't ever like to assume, and certainly when other people are listening, I don't want to ever assume that's the reason. However, I figured it was more of the training and the long-term strategy rather than what short-term fixes the underlying issue of day-to-day work and training is important.

One thing I'd like to back up to, Alex, if you can take a moment.

We've talked a lot about accommodations for kids and auditory processing in kids. What does the picture look like, if you could speak to it, for adults? Or, even adults in the work place?

**Alex:** Take yourself from the nine year old in the class room to the 29 year old in the work place. Now you've actually amplified the problem; except you've had 20 additional years to learn how to accommodate to your own deficit.

We human beings are very resilient; we learn to adapt.

I think adults adapt quite well. However, what I see in an adult with an Auditory Processing Disorder is a lot of the peer relationship challenges, direct love relationship challenges, in terms of communication and understanding.

Distractibility in the work place.....a matter of fact, the adult with Auditory Processing Disorder may actually be hyper-vigilant. They may be more aware and attune to



what's happening around them and have very difficult problems being focused to the task at hand.

We'll see work performance problems; challenges with advancing in career; jobs changing on a frequent basis; and we'll see lower frustration tolerance in the work place, especially if it's in a noisy environment or a place where they cannot control the noise.

One of the worst situations that we have for an adult with APD in the work place is a cubicle environment, especially in a large room that really amplifies all of the sound. It becomes a cacophony; the brain really can't make sense of it.

**Dr. Stern:** That's interesting.

So in some ways, when you're an adult in the work force, being a resilient person, you've somehow found strategies along the way.

However, in all likelihood, there will still be certain challenges that go unchecked or unnoticed and can even be just chalked up to "cubicle life, cubicle world;" or, the corporate lifestyle of, "Oh, this is just the way that it has to be."

You don't even realize that there are underlying concerns; that there are accommodations and programs that you can implement to get out of that.



**Alex:** We also need to realize that if we live with something that long, it just simply becomes part of who we are; we don't see it as a deficit.

**Dr. Stern:** Yes, it's another true point and is also the difficulty with adult ADHD or finding out mid to late adulthood that you had this whole lifetime experience and now, finally, there's a name for it; a reason for it. It can be very complicated.

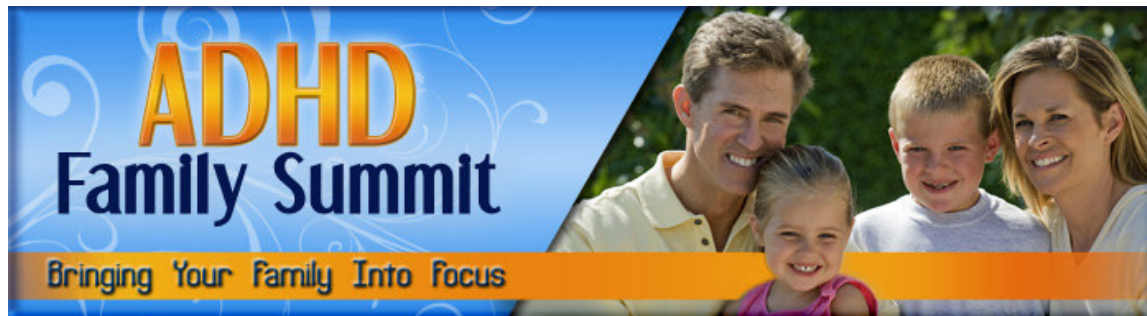
Alex, I feel like we're running out of time. I want to make sure that we've addressed everything that we can.

We've touched upon accommodations and briefly upon The Listening Program® and how music can help.

However, I feel there's a little bit more that you can say about the long-term training, certainly with your own software, or other important pieces that people need to be considering for being able to better manage auditory processing.

**Alex:** It is both treatment and improved management. The Listening Program® which our company, Advanced Brain Technologies developed is a music based intervention.

The family would have equipment, either on an iPod or with CDs and a pair of high quality headphones. They would work with a professional that's trained as a Provider with our organization.



They would do an in-take and design an individualized listening plan. That listening would be done 15 to 30 minutes a day, five days per week and generally over the course of 20 weeks.

Post-testing would be done to evaluate the response to the program. Then an on-going maintenance program may be defined.

It is a several month program. However, it is highly successful.

Today, in terms of looking at the long-term, there's actually a significant research study just starting at Howard University on The Listening Program® specifically with people with the singular diagnosis of Central Auditory Processing Disorder.

There will be a study on children, as well as adults, to look at The Listening Program® intervention as well as classical music that have not been modified in the ways that The Listening Program® has done. They'll do brain mapping and other behavioral testing to look at the response between the methods.

However, this type of work has been going on for the past 50 years in terms of interventions for these auditory-based issues.

**Dr. Stern:** Okay; that's excellent information.



One piece that I think is critical – you’ve mentioned it a couple of times. However, for people that are looking for more information, either from you or from Advanced Brain and The Listening Program®, how do we follow up with Alex Doman and Advanced Brain?

**Alex:** We just launched a redesigned Web site for the company this week. It’s at [www.AdvancedBrain.com](http://www.AdvancedBrain.com).

For the listeners that are on [www.Twitter.com](http://www.Twitter.com), they can follow me personally at [www.Twitter.com/alexdoman](http://www.Twitter.com/alexdoman). We also have a group on Facebook, as well as a community for people interested in the brain and technology at [www.AdvancedBrain.com](http://www.AdvancedBrain.com).

**Dr. Stern:** Excellent

I believe it’s also [www.TheListeningProgram.com](http://www.TheListeningProgram.com) for specific information on that.

**Alex:** Yes sir.

**Dr. Stern:** Okay. Last, but not least. Again, we’ve been family-oriented with a lot of talk about children. However, I do see questions coming in. Does your work and programs apply for adults as well?

**Alex:** Absolutely. We tend to speak to kids because that’s where our priorities are generally at, “Let’s take care of our children first.”



However, we work with a large number of adults. We actually have Providers that specialize in working with adults. It's equally applicable.

**Dr. Stern:** Okay. Now, just to cover our bases as we do have a very wide, broad audience with us for the ADHD Family Summit, let's say that there are providers on these calls who want to learn more about becoming a Provider. What is the best approach to do that?

**Alex:** To go to [www.AdvancedBrain.com](http://www.AdvancedBrain.com) and then to the section on training. We hold training courses worldwide – throughout the United States, UK, Ireland, Australia, New Zealand, Mexico, Israel, and Latin America.

They just find a training course and can register there. There are two and three day courses.

We also will be introducing a new online training format very soon.

**Dr. Stern:** That's fantastic.

Alex, are there any last words or comments in closing?

**Alex:** No, I just want to thank you, Rory, for giving us an opportunity to talk about auditory processing issues and how they relate to ADHD.

Thank you for including me in this Summit.





**Dr. Stern:** You're welcome. However, it's a mutual "thank you" for joining us. Thank you for the opportunity to share this critical information.

I do look forward to continuing our conversation and getting more in-depth in the future.

**Alex:** Thank you, Rory,

**Dr. Stern:** Thank you everybody. Alex, thank you. Thank you to everybody who has brought us into their homes and taken time to learn more about this.

We will be back Wednesday night, June 3<sup>rd</sup>, with a very special guest, Alexis Martin Neely. She'll be at Family Summit talking about stressors and external factors.

It's really critical that we look at certain things beyond just ADHD or beyond APD and anxiety and depression.

Alexis is a Family Wealth attorney who is going to be talking to us about very important systems that we can put in place to protect our family and future at low cost or no cost.

It'll be a very exciting call. You can check your email for details on that.

Again, thank you to everybody; have a wonderful night.

