



# Stuttering Research and Medical Updates

## QUESTIONS AND ANSWERS

At the 2020 NSA@Home Conference, a panel of expert researchers, clinicians, and professors shared summaries of recent research in stuttering across a variety of topic areas (etiology, genetics, medical aspects, and therapy approaches). There were many questions from session attendees that the panelists didn't have time to address.

**Below are answers to questions submitted in the chat box during the session.**

SESSION:	<b>Stuttering Research &amp; Medical Updates</b>
DATE:	July 9, 2020
PANELISTS:	<b>Gerald Maguire, MD</b> – University of California, Riverside <b>Scott Yaruss, Ph. D.</b> – Michigan State University <b>Shelly Jo Kraff, Ph.D.</b> – Wayne State University <b>Shahriar Sheikhbahei, Ph.D.</b> – National Institute of Health <b>Soo-Eun Chang, Ph.D.</b> – University of Michigan

Katie McCrary

**Question for the medical research panel, if time: Is there any new research on medications to reduce stuttering including the use of alprazolam (Xanax), propranolol or other anti-anxiety medications?**

### Gerald Maguire

We do have two new FDA registered research studies coming up—deutetrabenazine and ecopipam. These medications act on the naturally occurring brain chemical, dopamine. Alprazolam (Xanax) is in a class of medications known as benzodiazepines. These medications may assist with the social anxiety of stuttering and act on the neurochemical, GABA. Medications in this class have never been shown to directly help the fluency aspects of stuttering, unlike the dopamine medications.

Also, the benzodiazepine medications can be addictive and habit forming unlike the dopamine medications that have been studied and have been shown to be effective in treating stuttering. More definitive studies are needed and are beginning this year.

Bob in Michigan

**Stroke victims suffering the loss of speech seem to be able recruit undamaged parts of the brain to perform speech. Any application to stuttering therapy?**

### Soo-Eun Chang

Similar to stroke patients that often recruit homologous brain areas to compensate for damaged areas (e.g., activating the right inferior frontal area, when there is a damage to the left inferior frontal gyrus), it has been reported that people who stutter (PWS) exhibit increased activity in the right hemisphere regions when speaking, to a greater extent than is seen in non-stuttering speakers. Other cortical and subcortical areas have also been reported to be hyperactive in PWS, and these could be reflecting both compensatory and maladaptive changes in the brain associated with stuttering. The thing about these compensatory changes is that they often do not “normalize” function that it intends to support. Even in the case of stroke patients, better recovery is associated with re-engaging damaged tissue or immediately surrounding areas, rather than strengthening involvement of other homologous structures. Recruiting homologous areas could lead to a somewhat interfering, inefficient mechanism to support the function that is originally affected. So, to answer your question, yes PWS recruit parts of the brain that seem to support fluent speech such as when engaged in induced fluency conditions, but these structures do not necessarily support the speaker to develop fluent speech. It may be better to strengthen the areas and connections that are found to be weaker in PWS, and taking this approach especially during childhood may have a positive impact on stuttering therapies in the future.

Lisa Kutsch

**Do you show which ones have “recovered” vs those who have not?**

### Shelly Jo Kraft

Hi Lisa, yes, on the family pedigree there is a small black dot in the circles and squares where individuals have recovered from stuttering. I have been collecting DNA from people who have recovered as well as those with a persistent form of stuttering so that eventually we can identify genetic factors that are protective in nature or risk candidates for people who stutter. We make the assumption that “having ever stuttered” is sufficient in these families to have shared genes causal for the stutter, and we presume that epigenetic factors (genes + environment + genes x environment) will be at play to determine persistency/recovery outcomes. Epigenetic factors are just now being explored in many behavioral and medical genetic studies and are a goal for us to understand in stuttering once we have nailed down some initial genes.

Carl Coffey

**For family members who stutter, is there distinction between those who have persistent versus those who have “outgrown” their stuttering?**

### Shelly Jo Kraft

Hi Carl, you and Lisa (please see above) have similar questions. I love that people are thinking about recovery/outgrown stuttering as an important element to consider, even in genetic studies. I personally think it is huge. If we can understand what the brain and body does in some children to re-wire, mitigate, or accommodate stuttered speech patterns during this developmental window of childhood where stuttering can disappear (most often with the help of therapy), it will provide a pivotal place for scientists and clinicians in the future to develop targeted clinical therapies, drug therapies, and perhaps even gene-therapies for treatment.

Rachael Javaherian

**There is no one in my family that I know of who stutters, but I was a micro-preemie who, together with stuttering, acquired epilepsy, both of which seem to have been caused by a stroke (grey matter heterotopia) shortly after birth. Do you think that genetics figures somehow into this scenario?**

### Shelly Jo Kraft

Rachael, this is a great question and certainly something that makes sense to explore as you try to understand why you stutter. As your medical history is quite complex, so is the answer, so bear with me. 😊 Developmental stuttering is highly heritable, meaning we can estimate that for children who start stuttering between the ages of 2-6 years, more than 80% of that happening is due to inherited genes from your parents. Even if you have no knowledge of anyone else in your family who stutters, it is often there, but hidden from family history. A relative may have stuttered for a short period of time when they were children and no one remembers now, since it went away, and that occurred several decades ago. All of that being said, we do know that certain areas of the brain, when damaged by stroke or lesion, can cause stuttering. This would likely be present from the moment you started to speak. I know much less about the nature of stroke-based stuttering, but certainly strokes themselves can have genetic risk. You were a micro-preemie, which is incredibly miraculous (right?!) and a lot for your little body to work through in early life. In these scenarios that are atypical for early development, each body and brain responds very uniquely to support post-development and survival. It is hard to say with any certainty, whether the premature entrance into independent living, the stroke, epilepsy, or inherited stuttering genes from relatives are the specific cause. Likely, they all play a role and factor into your speech on some level. My research team is currently trying to capture more information on global health conditions not related to speech in people who stutter to investigate co-genetic regulation.

Bob in Michigan

**When you estimate / predict a person's DNA from the relative's DNA, what degree of accuracy do you find for your predictions, if back-testing has been performed?**

### Shelly Jo Kraft

Hi Bob, the degree of accuracy has to do with where the person is located in the pedigree and how large the pool of relatives surrounding the missing DNA is. When we impute the family DNA into the software with very limited "missingness" we can assume pairwise identity by descent of most individuals with confidence. I don't know what your background is, but the software pulls together linkage data, family based association, pedigree aware imputation, pedigree aware phasing, mendelian error checking, heritability estimates, as well as data from pVAAS (basically a gwas imbedded technology in a linkage design) to reconstruct the missing genetic data. Once the generated genetic data is in place we run additional software to predict the pedigree with the reconstruction to see if it matches the family data we collected by hand. It's the best we can do, and is often crucial to accommodate for missing data.

Darren

**I'm the only person in my family who stutters, but I also have migraines and autism, which do run in the family, and are also differences in the way the brain is wired. I wonder if any research has been done on if that is a common comorbidity.**

### Soo-Eun Chang

Migraines and autism have not yet been reported as common conditions that co-occur with stuttering.

### Shelly Jo Kraft

Hi Darren, we don't know much about how related migraines or autism could be to stuttering as there hasn't been a lot of investigation into this. Anecdotally, the prevalence of autism and stuttering together has not been sufficiently high enough to flag it in our clinical community as common comorbidity, but that doesn't mean they aren't influencing one another, and it certainly doesn't mean it doesn't happen (you are not alone). We don't really have solid data on how many people who stutter also suffer from migraines. We don't often ask about migraines when we do a speech evaluation for stuttering, so the numbers are rarely reported with any population accuracy. The good news is my lab is actually trying to capture this exact information to look at potential connections to other health conditions and perhaps co-regulation of genes. Here is the link, we would love to have your medical story included!

**RESEARCH OPPORTUNITY:**

Please help us understand more about the etiology of stuttering by taking a health history survey. We need adults, age 18 or over, with a history of stuttering to take an anonymous survey to gather information on the overall health and presence of unrelated conditions that can co-occur in individuals who stutter.

Click the link to participate:

[https://waynestate.az1.qualtrics.com/jfe/form/SV\\_b7vRtCaUTh7nEAB](https://waynestate.az1.qualtrics.com/jfe/form/SV_b7vRtCaUTh7nEAB)

Adam Ball

**How many base pairs is a typical gene?**

**Shelly Jo Kraff**

Hello Adam, most genes are between 10,000-20,000 nucleotides in length. That being said, they can be as small as 1,000 bp (that is a minimum really to make enough amino acids to support complete protein structures in the body). Some genes, like the one I spoke about are mammoth in size and are expressed in various parts of the body and in various ways. Genes that support the pigment color of your eyes, hair, skin, and even teeth (shade of white) express in the ears to support hearing, and express in the kidneys to support renal function. Gene maps can be really exciting as we move to understand more about regulation, expression, and networks.

Beth Bienvenu

**I spit into a test tube for a study at Wayne State at an NSA conference a few years ago and saw the researcher, a grad student from Australia, at subsequent conferences. Was her research part of this study?**

**Shelly Jo Kraff**

Hello Beth, and THANK YOU for your participation! YES! Your DNA is part of these genetic studies. Emily Lowther is one of my doctoral students and is nearly finished earning her PhD. She has collected DNA and worked on these grants for years. We are so appreciative of your contribution and you can be proud when we report from our genetic studies that the data represents you!

Bob in Michigan

**Has the apparent fluency effects of hearing changes been tested to eliminate the novelty effect? That is, any change in behavior, such as body motions, produce enhanced fluency, at least until the person gets used to it.**

**Shelly Jo Kraff**

Hi Bob, there has been some research in this area particularly under the delayed-auditory feedback condition. I can't say that much has been done to understand

the novelty effect, and how long it takes for some people to resume speech characteristic of what they have without speaking under a delay. Most of what has been done is along the lines of how people respond to speaking under a delayed auditory signal and what happens to their speech. The effects are varied, and I'm sure the novelty effect is too. Regardless, we do know that the way you hear yourself, for many people who stutter, has an impact on the motor speech (feed-forward) plan in some way. We need more research to understand auditory involvement for sure!

Arsen Tomsy

**Do those wonderful scientists need for support through donations?**

**Soo-Eun Chang**

Yes 😊

**Shelly Jo Kraft**

Arsen, you are a saint for asking. Funding is notoriously difficult to come by for stuttering research. All of the panelists are federally funded (very rare, highly competitive, and a huge achievement - definitely speaks to the caliber of research being done), but only for limited studies and for limited amounts of time. Any financial support from donors will always be welcomed! Please let any of us know if we can provide more details or contact information if you are interested!

**Scott Yaruss**

YES! Always, and direct research funding and funding through organizations such as the NSA allows us to explore new avenues that might not easily be supported by federal funding. This is particularly true for exploring new treatments—and, in particular, understanding the benefits of self-help and support groups for improving the lives of people who stutter.

Lisa Kutsch

**What do these genes indicate for stutters who recover or do not recover? Are there any medications or vitamins that have been shown to have an impact on these genes and brain matter?**

**Gerald Maguire**

We do have data on certain dopamine agents that have been shown to improve stuttering, like olanzapine, that they increase white matter formation. We will need to study this definitively in stuttering.

**Shelly Jo Kraft**

Hi Lisa, once we know what genes contribute to risk for persistency or assist recovery, we will be able to know more and do more. It is a sincere hope that genetic

discovery can inform new therapies for stuttering that might be as easy as nutritional supplementation. Even preventative approaches could be possible. We won't know without more research. We need more people participating in studies and studies being funded. I'm confident, however, that we will get there!

Matt Phillips

**Question for Dr. Chang - you mentioned that it seems in recovered children who stutter there is normalization of left hemisphere motor areas. I was wondering, in recovered CWS are there also neural structure/function differences in recovered CWS compared to children who have \*never\* stuttered, suggesting there are also compensatory mechanisms at play, or is this a true "return to normal"?**

### Soo-Eun Chang

The recovered children often show neural deficits that are similar to what is shown in persistent children. In other words, the stuttering group as a whole, regardless of later persistence or recovery, show some common differences in the brain compared to their fluent counterparts. What differentiates persistent and recovered kids is that in the former, this deficit seems to continue even with development, whereas in the latter, they seem to later adopt a more normalized pattern of growth with age so that the level of connectivities seem to converge to within normal range. With regard to compensatory changes in recovered children, we are just beginning to find some interesting differences when comparing recovered children to fluent (never stuttered or have family history of stuttering) children, in terms of basal ganglia and other subcortical area development. We will have more data on this soon and hope to report on it in the future.

M. Katz

**How do these genetic findings impact helping stuttering in the future?**

### Shelly Jo Kraff

Thanks for your question! Behavioral studies (as done historically to understand stuttering) are a top down approach. Once they measure stuttering characteristics as observed on the outside, they look deeper to mechanisms that could create or support those characteristics (kinematic motor skills, psychology, behavior and learning etc.) Imaging and neurological based studies are a middle approach. They are an attempt to go below where can access with theory and behavioral testing from top-down approaches to see what the brain is doing functionally or anatomically to manifest what we observe in stuttering. Genetics offers a bottom-up approach. It is unique in the way that we can isolate genes in a hypothesis free approach (we have no idea where to look so let's just sample across the genome and see what stands out when we compare large groups of people who stutter, with the genetics of large groups of people who don't stutter). Once we find a gene, or hundreds of genes, we can then work upwards to see how those genes work. Where

they express themselves, and how they fit with the middle and top down data that we have. As the cause of stuttering has been so elusive, it will be really exciting to see what transpires from this bottom up approach and what we can do with that data to create new treatments, therapies, and preventative strategies for stuttering.

Ian Nunes

**Do you think that a big moment is coming, for stuttering research? Will a definite cause of stuttering be known within the next few years?**

### Soo-Eun Chang

We will definitely know more about the mechanisms associated with stuttering and about what may be associated with persistence or recovery of stuttering, but it is not likely that we will know a “definite cause of stuttering” in the next few years. I say this as I examine the discoveries being made in other fields that also deal with complex neurodevelopmental disorders similar to stuttering. Researchers in these fields are presented with challenges in understanding the biological bases of these neurodevelopmental disorders, similar to what we face in stuttering. These include the areas of autism, ADHD, dyslexia, developmental language disorders, and the like. In all of these cases, there have been much more research conducted than in stuttering and we definitely know more about their neurological and genetic bases, but I don’t think the researchers in those areas would say that they know the “definite cause” of these conditions. In all of these conditions, it is likely that multiple, perhaps thousands of genes are involved, and multiple, complex, large-scale brain networks are involved to affect such complex functions that affect functions at a human level (e.g., cognition, attention, reading, speech, as opposed to say, a blood clotting disorder). In order to understand the complex mechanisms behind such a disorder, we have many more puzzle pieces to discover and these need to be put together to start understanding the pathophysiological bases of stuttering.

Nadings

**Just a thought when it comes to auditory effects on stuttering and fluency. It is a bit simplistic to say that if you stutter you are fluent with white noise, delayed auditory feedback, etc. That is not really the case in my experience as a stutterer. I participated in some studies with DAF, etc and did not find it helpful. There are instances where it may be, but wanted to insert that into the comments. Thank you very much for your presentation!**

### Shelly Jo Kraft

Hi Nadings! You are completely correct. The fluency response to auditory conditions are varied from person to person. Many people who stutter report that they can induce fluency by speaking to a rhythm, with a metronome, while singing, while speaking in unison with someone else, while whispering, with a delay, with a pitch shift up or down, or when their voice is masked by white noise, but that might not be

the case for everyone under every one of these conditions. There will be many genes that contribute to stuttering, and they will impact the way stuttering shows up in each individual person. Every person who stutters has their own unique stutter and characteristics. Hopefully, a general auditory component that exists in some form for many people who stutter will be better understood soon. Most importantly, is the point you raised in your comment, that everyone is unique and we need to be mindful to account for, and include, all types of people (and stutters) in our research without a blanket one-size fits-all-approach or explanation.

Greg Feasel

**Two questions for Shelly Jo Kraft: I have an older brother -- biological brother. He doesn't stutter. How come stuttering doesn't hit both siblings? None of my immediate family members stutter. My Dad had a cleft palate. Is there any connection between a stutterer and other kinds of speaking disorders?**

### Shelly Jo Kraft

Hi Greg, you are not alone with this question. Why me? We know that we only share 50% of our DNA with our siblings. So the easy answer is you have some genes that your brother does not, however, the answer is also more complex. Our genes are only part of the equation. Our genes only show up as behaviors (in this case stuttering) by interacting with our environment and in addition to our environments. Our environment isn't just where we live.. it is absolutely everything about you, what you done, been exposed to, experienced, or ate since you were conceived. Hormone levels in your mother's womb interacting with genes you inherited from your father might regulate a gene to express proteins that contribute to axon guidance of neurons in your sweet little developing brain before you were even born. The chair you are sitting on at this very moment is exchanging electrons and chemicals with your skin at this very moment, changing the way the DNA in your skin reacts and responds to future chairs. I had the honor of presenting with a brilliant researcher a few years ago, Barbara Lewis at Case Western Reserve University, who has been collecting data for many years on the families of children with speech and language diagnosis and she found that often families with one condition, had a history of others. Stuttering is likely caused by many, many genes. These will undoubtedly have an impact on many features, anatomical and functional, that can be inherited and show up in various forms.

Allison Daly

**Is there a way to explain the etiology of our stuttering if we are the first person in our family to stutter?**

### Shelly Jo Kraft

Developmental stuttering is highly heritable, meaning we can estimate that for children who start stuttering between the ages of 2-6 years, more than 85% of that

happening is due to inherited genes from your parents. Even if you have no knowledge of anyone else in your family who stutters, it is often there, but hidden from family history. A relative may have stuttered for a short period of time when they were children and no one remembers now, since it went away, combined with the fact that it occurred several decades ago. Many people are in your shoes, I've had several clients who have contacted family members to ask directly about stuttering (versus just thinking about everyone and judging by what they observe that no one else stutters) to ask if anyone may have stuttered as children. Several have come back with more family history and some still report none. We are getting better with electronic medical records and school speech pathology services at noting these histories, but we are so lacking when it comes to knowing about our grandparents' speech during childhood. I asked a 93-year old about any family history of stuttering in his older relatives (all dead and gone). Mind you, I asked because he has a son who actively stutters with a moderate overt stutter, a grandson who stutters, and 2 great grand children who stutter. He looked at me and said "I don't know of anyone who stutters! I use to know a guy named Paul that I worked with who stuttered, but haven't ever met anyone else!" Needless to say, I'm pretty sure he was aware this own son struggled with a severe stutter as a child and still stutters, but it was lost to him. So take that bit of understanding with you as you approach family history. Sometimes it's there, just not easy to get reliably when it depends on the report of what feels like ancient history.

### **Gerald Maguire**

We do report cases such as yours where stuttering presents when there is no family history. Data will soon be published which will explain how this may occur in some individuals. It is likely we have numerous causes of stuttering and we will present/publish these findings soon.

Taylor Menaker

**Is stuttering more present in certain ethnic groups? I am wondering how far back in history these genes go**

### **Shelly Jo Kraft**

Hi Taylor, we have record of stuttering going back as far as Aristotle, the ancient Greek philosopher who lived from 384-322 BCE. Current epidemiological reports still reflect a flat prevalence rate across racial, cultural, and ethnic groups. That being said, we are (hot off the press) capturing more accurate data with mandatory well-baby visits and electronic health records that are consistently showing that more people globally are affected by stuttering than historically reported. A few years back reports from Australia showed a high prevalence for stuttering there that almost doubled the world reports, but the new data coming from countries with nationalized health data-bases is starting to approach and approximate those numbers as well.

Lisa Kutsch

**Since most stutters have period of fluent speech is there a “short circuit” or missed connection when there is a period of disfluency?**

### Shelly Jo Kraft

Lisa, I love your questions. We as scientists have the exact SAME questions! We honestly don't know what happens to explain this and why. We are all individually taking a deep look within our research arenas at neurotransmitters, cell-cell communication, connectivity, and regulation of motor control and the individual experience of each moment. Stuttering is so complex and there are so many systems involved that we are trying desperately to answer this exact question.

### Gerald Maguire

We do have evidence to believe that stuttering is under the influence of the basal ganglia. In simple terms, the lack of functionality in this circuit can explain the difficulties we persons who stutter experience in the timing and initiation of our speech. It can also explain why, under certain emotional states, why we stutter more or less. It also puts forth a mechanism as to why we people who stutter are often fluent when singing or conducting chorus reading.

Rachel Love Martinez

**Do these genes make our stuttering final or is there a way to alter these genes to make them more normalized?**

### Shelly Jo Kraft

Hi Rachel, we anticipate that there will be a lot of genes that contribute to stuttering. We can absolutely work with gene expression once we have targets. Depending on the genes and nature of how they function, we hope to be able to create new treatments, therapies, and preventative strategies for stuttering.

### Gerald Maguire

As per my colleague, Dr. Kraft, correctly states, we have the potential to create therapeutics—medications, etc—that target the abnormalities that may be expressed from the genetic abnormalities.

Lisa Kutsch

**Is the Gnptab mutation a natural occurrence in all animals or only in humans?**

### Shahriar Sheikhbahei

Hi Lisa, in general, DNA/gene mutations can happen in all cells and animals. However, I am not aware of any report on natural incidence of this 'specific mutation' in *GNPTAB* gene in other animals.

Darren

**I think I hinted at my question earlier, but to be more explicit, I have migraines and autism with sensory processing disorder, both of which run in my family, as well as a stutter that doesn't. All of these are differences in how the brain is wired that show up in an fMRI. What research, if any, has been done or is planned as to whether this type of comorbidity is common and if there is some sort of correlation/common causality?**

**Shelly Jo Kraft**

Hi Darren, I answered in your earlier post. Check the thread above 😊.

Bob in Michigan

**Can methods of Gene Replacement Therapy penetrate the blood brain barrier?**

**Shelly Jo Kraft**

Hello Bob, nice question! You are correct that the BBB is very difficult to penetrate with standard recombinant proteins. The use of viral vectors have proven to be moderately effective in some cases as well as small-molecule infusions directly into the CSF. That being said, we have other avenues to target genes and genetic expression that may not require genetic alteration, but rather regulation of or management of bi-products (neurotransmitters, nutrients, connectivity, preventative medicine/strategies). Luckily, biological engineering is rapidly evolving and keeping pace with genetic technologies, so we can hope to cross that river with a boat that floats when we get there!

Ronak Nambiar

**Is stuttering more common in smaller animals?**

**Shahriar Sheikhbahei**

Hi Ronak, because stuttering a human disorder, I don't believe vocal adult animals (regardless of their size) stutter at all. The fact that a specific mutation in *GNAPTAB* gene is linked to stuttering in both human speech and mouse vocalization suggests that the brain circuits controlling the complex behavior of vocal production is similar in these species. Therefore, I do believe that it is possible for vocal animals to have specific disorders related to their vocalizations. Just remember in the mice data that I presented, researchers have 'inserted' human stuttering genes into the mouse genome and surprisingly, the pattern of mouse vocal production was affected (similar to the human who has the mutation and stutter).

Mark Winiski

**For Dr. Sheikhbahei - did you find any information (if possible) on mice reactions to their stuttering and if that affected the patterns and severity?**

### Shahriar Sheikhbahei

Hi Marc, this is a great question, but it would be difficult to study the effect of stuttering on the behavior of the 'stutterer' mouse in a well-controlled setting. However, I know Dr. Drayna has unpublished data on behavior of other mice when interacting with these 'stuttering' mice in a social setting. I recommend you listen to his recent interview at Stutter Talk:

<https://stuttertalk.com/the-genetics-of-stuttering-with-dr-dennis-drayna-from-the-nih-ep-684/>

Mary Barrett

**Is there a "nurture" aspect to stuttering, or is it all "nature"? My siblings had a mild stutter when we all lived at home. Since adulthood, neither of them stutter. I've often wondered if they picked up on my speech as kids.**

### Shelly Jo Kraft

Hi Mary, this is a question that so many parents and family members share. Stuttering is inherited. You and your siblings all stuttered as children because you all received some combination of genes from your parents for stuttering. They "recovered" as children (common in many children) and you went on to "persist" and stutter into adulthood. Studies looking at the inheritance pattern of those who recover vs. those who persist do not show any solid trends. Meaning, we know that stuttering is passed down from generation to generation in families. Many times our older relatives stuttered while young children and then "grew out of it" or had therapy assisted recovery (sometimes we don't even know that they ever stuttered because it was so long ago and there was never any record made of our grandparent's childhood speech). There isn't a genetic trend for why some kids stop stuttering and others don't. We are trying to understand that very detail in the genetic studies that I am conducting. We are hoping to find extra genes that regulate risk for whether you will likely stutter life long, or recover as a child. The great news is you didn't make them stutter as kids, they did it on their own. 😊

### Gerald Maguire

We do have evidence that environmental factors may lead to stuttering. More evidence is growing that stuttering, in some individuals, may be an autoimmune condition. With exposure in the environment, at the vulnerable time in development, stuttering can be triggered.

Joe Chadowski

**Have any studies been done on how other mice treat a mouse that stutters?**

### Shahriar Sheikhbahei

Hi Joe, thank you for asking this question! We designed experiments to get answer to this question. I know Dr. Drayna has some unpublished data on how female mice treat the stuttering male mouse. I recommend you listen to his recent interview at Stutter Talk:

<https://stuttertalk.com/the-genetics-of-stuttering-with-dr-dennis-drayna-from-the-nih-ep-684/>

Matt Dorn

**How does anxiety and stress factor into the genes of stuttering? Is there an anxiety gene? Some people have really bad anxiety and some have little. Why?**

### Shelly Jo Kraff

Hi Matt, we absolutely know that stress and anxiety contribute to stuttering severity for most people. People who stutter are not more anxious in general, it is very individualized just as anxiety is very individualized for people who do not stutter. But as you mentioned, it seems that stress and anxiety can play a role, and there is a need to understand the possible genetic relationship anxiety might have with stuttering. My lab is trying to find out more about how many people have underlying health conditions not related to stuttering to look at co-regulation of genes and conditions that we haven't identified in the past (when you go for a speech evaluation or for stuttering therapy, clinicians don't ask about broad medical health history, nor do doctors put stuttering in a health chart when you go in for a cold or flu). We would love to have your contribution. I'll list the link if you want to anonymously participate. My hope is that we can understand more about people like you and other health conditions that might be influencing stuttering that we haven't investigated yet.

#### **RESEARCH OPPORTUNITY:**

Please help us understand more about the etiology of stuttering by taking a health history survey. We need adults, age 18 or over, with a history of stuttering to take an anonymous survey to gather information on the overall health and presence of unrelated conditions that can co-occur in individuals who stutter.

Click the link to participate:

[https://waynestate.az1.qualtrics.com/jfe/form/SV\\_b7vRtCaUTh7nEAB](https://waynestate.az1.qualtrics.com/jfe/form/SV_b7vRtCaUTh7nEAB)

### Gerald Maguire

We do know that people who stutter have a higher co-existence with social anxiety disorder. One can easily state that stuttering results in anxiety. However, given the genetic linkages seen among stuttering and other neuropsychiatric conditions such as ADHD, OCD, we understand that there is likely a biologic underpinning as to why people who stutter have a higher risk of social anxiety than people who do not stutter. We have evidence that the basal ganglia region of the brain likely plays a

role in stuttering and anxiety stresses this circuit more. A region of the brain, the amygdala, is a key region of the brain involved in anxiety and it is also involved in stuttering.

Katie McCrary

**Is there any new research on medications to reduce stuttering including the use of alprazolam (Xanax), propranolol or other anti-anxiety medications?**

### Gerald Maguire

Benzodiazepines tend not be effective for stuttering except for the co-existent anxiety. Sertraline not effective as well. Anxiety tends to make stuttering worse. Will review

mattbell

**Question for Dr. Kraft - Can environmental factors alone cause stuttering in a child or does there always have to be a genetic link?**

### Shelly Jo Kraft

Hi Matt, from my professional viewpoint, stuttering always has a genetic link. The heritability estimate is greater than  $>.85$  (HUGE in genetics) and reflects the amount of direct genetic contribution to your speech. There was a historical "Monster Study" that took place in the 1950s to attempt to prove that you could make someone have a stutter by belittling them and making them fearful to speak (this was the investigator's personal agenda to prove that his over-bearing mother caused his stutter).

The study showed that they could make school-age children have dis-fluent speech, characterized by hesitations and short repetitions, but it wasn't the same as developmental stuttering. The disfluencies they were able to induce went away after the study ended (thank heavens, poor kids were incessantly verbally attacked by adult teachers and classroom aids for the duration of the study). It was very psychologically traumatizing for the children involved (a large law-suit ensued many years later), and would never pass human-ethics approval for studies happening today, hence being called the Monster Study.

In the end, we can be thankful for what we learned from it. You can't cause stuttering. The cause of developmental stuttering is genetic in nature.

### Gerald Maguire

We have reported cases in the literature where stuttering can be viewed as an autoimmune disorder and such usually begins in childhood. The immune response is genetically influenced but environmental exposures play a significant role.

Colleen Stoyas

**Can you speak to why altering M6P signaling with Gnptg mutations could lead to a fluency disorder? Specifically why would changes in lysosomal targeting translate to stuttering?**

**Shahriar Sheikhbahei**

Hi Colleen, we don't know the mechanism YET! My group actively works on this problem and we have two hypotheses, but they are not mature enough that we can share them at the moment. I hope to tell you more about this next year!

Izzy Fridman

**Accepting stuttering often brings fluency. Please explain this from a scientific view.**

**Scott Yaruss**

Hi Izzy. Great question. One of the things that we know about stuttering is that there's far more to the experience than just the underlying genetics and neurology that might help to explain its onset. The experience of stuttering is also affected by many other factors (which are also genetic and neurological in origin), and it's the interaction of these many factors that determine whether or how or how much a person might stutter. Among those other factors are the reactions the person has to stuttering. The more negatively a person reacts to stuttering (in part, due to inherent factors like temperament, and in part due to experiences in life), then the more likely the person is to struggle with stuttering. Less acceptance tends to lead to more struggle. As a person learns to accept stuttering and to become more comfortable with it, then the struggle reduces. The result is easier and more fluent speech. Thus, the link between the acceptance and the fluency is an indirect one.

Related to your question is a statement that Wendell Johnson made in the 1950s. In essence, he said that "stuttering is what the speaker does to avoid stuttering." He was referring to the fact that a lot of the surface behavior of stuttering is part of that struggle – that attempt to avoid or prevent stuttering. When that attempt to avoid stuttering is diminished, the overall stuttering is also diminished.

We also have recent data from my lab (Tichenor & Yaruss, 2019) showing that people who try to be fluent when they talk also tend to have greater adverse impact in their lives associated with stuttering. The more one tries to run from stuttering, the more trouble one has. This is why acceptance is such an important part of the journey for many people. It not only leads to improved life outcomes; it also leads to less struggle and, ultimately, easier and more fluent speech.

Filomena - Massachusetts

**Since Dr. Sheikhbahei talked about breathing - I'm wondering if there's any**

**research on effect of meditation (and/or breathwork of different kinds) and stuttering. Thank you!**

### Shahriar Sheikhbahei

Hi Filomena, it's a great question. I am personally not aware of a well-controlled study looking at the effect of meditation and stuttering.

### Scott Yaruss

Hi Filomena – A student of mine and I did a study years ago now on the effects of somatic education (e.g., Feldenkrais) on stuttering. As part of that study, she did a comprehensive literature review on relaxation work and found that relaxation in and of itself does not enhance speech fluency. That's not to say that it was a bad thing – people who are more relaxed overall or who have better awareness and control over their physical tension may have better life outcomes. This isn't directly related to breathing and meditation, but one of the goals of meditation is often greater relaxation and peace. Those are always good things to strive for anyway – they might not lead to direct fluency improvements, but they can help with the other aspects of stuttering, and that's a good thing in and of itself.

Rachael Javaherian

**Question for Dr. Sheikbahei - Is it a mutation in the GNPTAB gene that may be starting with us if we don't have anyone else in our genealogy who stutters?**

### Shahriar Sheikhbahei

Hi Rachael, I think one of the take home messages from the NSA symposium was that genetics play a huge role in the pathophysiology of developmental stuttering. It means is that people who stutter receive 'mutated' gene(s) from one or both of their parents. And remember, we have only discovered a few genes that a mutation on those links to the developmental stuttering.

Luz Salazar

**General question: I just graduated from UC Riverside with a BA in psychology and I am interested in doing research on the psychological effect of people who stutter over the lifespan. What is the best way to get involved in this research? would that be graduate school if so what field?**

### Gerald Maguire

I suggest you go to grad school that has a program that will support you in stuttering research. I invite you to apply to come back to UC Riverside!

### Scott Yaruss

Hi Luz – we've been in touch already...

William Parry

**What is the explanation for teen-onset stuttering? I have several clients who did not start to stutter until suddenly in junior high school.**

### Shelly Jo Kraft

Hello William, most of the time my assumption is that they stuttered for a short amount of time (2 weeks, 2 months?) while they were very young children (2-3 years old in the context of lots of new speech, and working through sounds and words) and it flew under the radar because it quickly went away, or they stuttered so mildly as children (maybe again for a short time) that it flew under the radar. Hormones and growth spurts seem to disrupt and affect stuttering severity. Many kids who stutter see an increase in severity during their teen years, so it would make sense for a huge surge in both growth and hormones to bring a stutter back from the past or make it suddenly so severe it appears like it is a whole new thing compared to the very mild, very rare, disruption they were used to.

### Scott Yaruss

Hey Bill. Thanks for joining the session. I also have had reports – and worked with clients – who simply seemed to start stuttering with no apparent prior history at all. Maybe it was unnoticed, as Dr. Kraft indicated... but, sometimes, we do indeed see unexplainable stuttering onset. In my career, I've treated about a half dozen people with this type of unexplained onset. One of the many great mysteries of the condition!

Lisa Kutsch

**Can you please write up the upcoming trials and medications in the questions document?**

### Gerald Maguire

Ecopipam in Stuttering can be found on ClinicalTrials.gov. The deutetrabenazine study will also be posted on this site.

[Effects of Ecopipam or Placebo in Adults With Stuttering \(Speak Freely\) – click link](#)

Recruitment Status : Not yet recruiting

First Posted : July 30, 2020

Last Update Posted : July 30, 2020

Howard Kilburn

**Are there any childhood behavioral activities/characteristics that have been shown to affect stuttering? Being bilingual, music exposure etc.**

### Scott Yaruss

Hi Howard. Thanks for your question. This has been examined in a variety of different ways over the years, and we don't have any indication of particular experiences, activities, or exposures that might explain the onset of stuttering. The origins are more likely to be found in the genetic and neurological differences. Of course, the experiences can affect how people live with their stuttering, but we don't have anything to indicate the cause from these other factors. (Specifically related to being bilingual: for a while, people thought that bilingual children were more likely to stutter, but more recently, we have learned that this is just not the case. Some children who are bilingual might exhibit more of certain types of disfluencies that can be confused with stuttering, but this is not the same as stuttering. So, we need to be careful not to over-identify children who are bilingual.)

Patrick Campbell

**Question for Shelly Jo Kraft - impressively sized group of people who stammer. Any evidence of Drayna's gene findings being replicated in your cohort?**

### Shelly Jo Kraft

Hello Patrick, we have been specifically looking for all three gene mutations identified by Drayna's work in our studies and have not found a single one to even be approaching significance. We are conducting family studies (as I spoke about during the talk) and genome-wide association studies that compare unrelated cases with controls and haven't found his genes in any of our data. It would be great to find genes that can be replicated so we can move forward to understand how they work in the general population of people who stutter. There will likely be many genes that cause stuttering, any of them being replicated by a data set separate from the discovery study will be a home run for the field.

Matt Dorn

**Dr. Maguire - Any connection with stuttering and treatment of ADHD with medicine?**

### Gerald Maguire

Yes---ADHD medications, specifically the stimulants, usually worsen stuttering. The proposed mechanism is that they increase dopamine which we believe is over-active in the brains of people who stutter. One can still effectively treat ADHD with non-dopamine agents such as guanfacine and atomoxetine.

**Kerensa Saljooqi:** *I'm directing the study from Emalex. There's only 8 sites in the US and we're launching early September. Anyone interested can email me at [ksaljooqi@emalexbiosciences.com](mailto:ksaljooqi@emalexbiosciences.com) and I'll send you the link to the website when we launch.*

Jeremiah

**Any meds can help with a little stutter??**

## Gerald Maguire

Yes, we have many medications available which can potentially reduce stuttering severity. More research is warranted and is ongoing.

Joseph Clayton

**I am interested in knowing if there have been any studies on chemicals in the body/brain that are more predominant when we feel more confident and the effects on stuttering. Like most people who stutter, I have found that when I'm feeling more confident, my speech improves and I'm wondering if chemicals in the brain can affect the neurons in the brain and how they communicate with each other. I hope that makes sense enough to answer the question properly. Thank you.**

## Shelly Jo Kraft

Hi Joseph, I don't personally know much about specifics in this area, but there is an entire field of sports psychology that would have details for what you are looking to understand. The overlap with stuttering is very real as your mindset and confidence to making a basket or goal (or not making a basket or goal) is hugely influential to your motor control as the way you are thinking about your speech influences your speech motor control (the more you stress about the stutter the more it happens). We know they are connected, without a doubt. It would be great to pull some of that sports psychology knowledge over to stuttering, right?! It's amazing how the mind and body are connected.

Jonathan Du

**I'm current med student at Georgetown going into radiology, and I am hoping to get involved in research involving stuttering and neuroimaging. What is the best way to get started?**

## Soo-Eun Chang

You might first seek who in your institution is doing neuroimaging research. Typically the ones that do neuroimaging research geared toward understanding cognitive and speech function, and some geared toward understanding clinical disorders, will be in psychology, cognitive neuroscience, or psychiatry. You might reach out to one or two individual PIs in these departments who have an active research program that have published influential papers and are able to support training new people on data acquisition, analysis, and interpretation. If you have more questions, please reach out to me and we can chat more.

## Gerald Maguire

Hi, Jonathan. Please stay in touch with me prior to your applying for residency.

Fa

**These new medication under study is the expectation that the effectiveness will decrease as the body builds a tolerance to it.**

### Gerald Maguire

Based on the mechanism of these agents, a tolerance will not be seen. In our use clinically with numerous patients over the past 20+ years, we have not observed tolerance. We will be researching this more definitively.

Hallie Mintz

**Are the participants in your medication trials also receiving traditional speech therapy throughout the trials?**

### Gerald Maguire

Not at this time but such is a study that Dr. Yaruss and I have dreamed about and plan to do so in the future!

### Scott Yaruss

Indeed, we have long talked about the potential value of a combined approach. We're a few steps away from being able to do that yet, but we are indeed looking forward to that day.

Luz Salazar

**Who has access to these medications? Can anyone get these or what is the procedure in order to get these prescribed?**

### Gerald Maguire

A physician can prescribe any of the dopamine medications mentioned. Ecopipam is not yet available by prescription and the studies are being conducted to determine if this medication will be available for wide-spread use.

Tricia Opstad

**Are the medications paired with a psychological and counseling program?**

### Gerald Maguire

Yes—the medications can show improvement on their own, but one can elect to receive psychotherapy and speech therapy at the same time. One may often achieve even better benefits by utilizing these three treatments collaboratively but definitive research is needed.

Karpel

**I am from Canada, Toronto. is there a suggested medical contact here.**

## Gerald Maguire

Dr. Roger McIntyre, at the University of Toronto, is an excellent psychiatrist and is very knowledgeable in the use of these classes of medications.

Kevin Onorato

**Dr. Maguire - If a drug was shown to be promising to treat stuttering but the patent was gone (like you mentioned for pagoclone), would the lack of financial incentive mean the drug would never see the light of day?**

## Gerald Maguire

Unfortunately, Kevin. Yes. Such is the nature of our system which has many shortcomings. As an example, the US government could not bring forth its own coronavirus vaccine. Our government partnered with a pharma company. We need a better system of therapeutic development.

Michele

**What about Zoloff? It is used for depression and social anxiety. I have found it to reduce my social anxiety in general and related to stuttering.**

## Gerald Maguire

Absolutely, Michelle. Zoloff, or sertraline, is very effective in reducing social anxiety. In our practice, we often combine serotonin agents like Zoloff (sertraline), which reduce social anxiety, with dopamine medications which have been shown to reduce stuttering severity directly.

Jeffrey Green

**How do I get my son in the Ecopipam study?**

## Gerald Maguire

Please register at our website: <https://speakfreelyregistry.researchstudytrial.com/>

Lucy Reed Ward

**Dr. Chang - Please restate the excellent explanation of stuttering you made in your introduction.**

## Soo-Eun Chang

Hi @lucy, I think what I said in the introduction went like this: Like most complex disorders, stuttering is diagnosed based on its symptoms (as opposed to with more objective biological markers such as with a blood test for example) and the cause is likely multifactorial, with genes and environment playing a role in how the behavior of stuttering is manifested in an individual. Genes and environment interact to affect neural function, which can be captured by neuroimaging techniques. Compared to

genetics, brain anatomy and function provide a closer, or more proximal window into the behavioral manifestations of stuttering, which comprises not only the core symptoms of stuttering but can also be accompanied by and affected by linguistic cognitive sensorimotor and emotional development.

Bob in Michigan

**Dr. Yaruss - Has stuttering been evaluated as a Traumatic Stress. Not a POST traumatic stress, as it never ends. What is the effect on living with a stress that you know will never end, and you get up every day knowing you will face it?**

**Scott Yaruss**

Hi Bob. Thanks for the question – it's a good one. Indeed, some people who stutter are indeed living with an ongoing trauma, and that can have a dramatic effect on how they experience the condition. This is the reason that so many of us focus our therapy on the big picture, rather than focusing too much on just the fluency. Sure, fluency is part of that big picture, but there's so much more to stuttering than that. Looking at how some of that ongoing trauma affects people who stutter is a key part of our ongoing research (<https://stutteringlab.msu.edu>) – for example, we have data on suicidal ideation in people who stutter, and we have many other studies planned examining the broader adverse impact that some people who stutter experience. The more we understand that, the more we may be able to help people through the difficulties that may be associated with living with stuttering.

Sam

**Has there been much research on late-onset stuttering? I didn't begin to stutter until I was about 18. There was no triggering event to my knowledge - it just seemed to develop in the natural course of things at that point. Is there any thinking about what could cause this? And should speech therapy be done any differently for late-onset?**

**Shelly Jo Kraff**

Hi Sam, another viewer asked a very similar question, here was my response to him regarding teen onset: "... most of the time my assumption is that they stuttered for a short amount of time (2 weeks, 2 months?) while they were very young children (2-3 years old in the context of lots of new speech, and working through sounds and words) and it flew under the radar because it quickly went away, or they stuttered so mildly as children (maybe again for a short time) that it flew under the radar. Hormones and growth spurts seem to disrupt and affect stuttering severity. Many kids who stutter see an increase in severity during their teen years, so it would make sense for a huge surge in both growth and hormones to bring a stutter back from the past or make it suddenly so severe it appears like it is a whole new thing compared to the very mild, very rare, disruption they were used to." I would guess, Sam, that something like this was part of your history, though it is impossible to verify in hindsight. Therapy for late-onset would be the same as therapy for adults. We treat

therapy for young pre-school age children near onset very differently because they are within the “zone of proximal development” for speech and the neuroplasticity is so flexible that we can often help the brain to route a new path for fluent speech while it is pumping new neurons into the system for speech anyway. It's like adding a side walk to a road that is already under construction. For adults those roads are basically in place and we haven't quite figured out how to re-route them easily.

### Scott Yaruss

I added on to that one up above too ;-)

Anita Blom

**Is the WHO still interested in stuttering? Can we cooperate somehow to get a better status for stuttering, as we still get to hear "stuttering isn't a problem" on a daily basis?**

### Gerald Maguire

Hi, Anita. I communicated with WHO some time back but nothing in return. I am hopeful they will reengage. If you can assist, count on my support!

### Scott Yaruss

Hi Anita – The WHO does indeed recognize stuttering. It appears both in the ICD and in the ICF. There is even an example in the appendix materials for the ICF of a person who stutters. ASHA had representation on the development panel for the ICF, as well. And, the ICF forms the foundation for the scope of practice for speech-language pathologists in the US. For my part, I have written 3 papers describing how the original ICIDH and now the ICF can be used in the study of stuttering. The ICF forms the foundation for the OASES. I'm happy to share those papers with you – just email me at [jsy@msu.edu](mailto:jsy@msu.edu). This is not to say that there isn't more that can be done to increase awareness about stuttering – indeed, we have much more to do. But, I'm not sure that the WHO is going to be where that comes from.

Joseph Clayton

**This study interests me very much since it's the everyday experiences of being a person who stutters and how we cope with those experiences and not only that but create a new reality and how we feel about ourselves that will go a very long way in our success and how we can help others who have the stuttering disorder. I would like to use some of this material in Educating & Advocating Stuttering Awareness and have as a topic for a future NSA Chapter I would like to lead. Thank you.**

### Scott Yaruss

Indeed, Joseph, that is very. Much the idea. The more that we understand how people can do this, the more we can help people in therapy or in support

organizations such as the NSA. The first step is better understanding the challenges that individuals face. This is the main focus of this part of our research, in fact. The goal is not to say whether people who stutter exhibit X characteristic more than people who don't stutter. That type of work has been done for years, and we've learned a ton from it. Now, we are moving on to asking, for those individuals who do have characteristic X, how does that affect their experience of stuttering? Can we use that understanding to improve their lives? The focus on individual differences is just at the beginning stages, and we have much to do, but I believe that it will be a very valuable path for research and for helping those who stutter.

Anita Blom

**Any positive effects from CBD oil?**

### Gerald Maguire

Hi, Anita. We have data that THC can help tic disorders—similar to stuttering. We have no studies with CBD but anecdotal use suggests perhaps efficacy in stuttering but research is needed.

Vantiel

**Not sure who to direct this question at but: Is there active research/interest into using AI (e.g neural networks & deep learning) to help give insight into stuttering? Also does transcranial direct current stimulation play a future role as an alternative (or augmentative ) therapy**

### Soo-Eun Chang

I answered privately to Vantiel but will repeat my answer here. My research lab has an active clinical trial involving tDCS and we are interested in expanding into tACS as well. We presented a poster at the recent OHBM meeting (Organization for Human Brain Mapping) that involved machine learning method to analyze whole brain neural network data. We are preparing to submit this work to a peer reviewed journal at this time.

Colleen Stoyas

**To Drs. Maguire and Yaruss - are a lack of PROMs contributing to the disinterest of pharma?**

### Scott Yaruss

Hi Colleen. In fact, we do have a validated patient-reported outcome measure for stuttering that has been used in pharmacological trials. And, it will be used in the upcoming trial. It's been used in dozens of other studies around the world, as well. That's the OASES – Overall Assessment of the Speaker's Experience of Stuttering. (Disclosure: I'm the co-author and publisher of the OASES.) It was developed following the FDA's PRO guidance (well, it was developed at the same time that the

guidance was being released, but then we did additional validation after that to ensure that we met the criteria.) I'm happy to provide more info – just email me at [jsy@msu.edu](mailto:jsy@msu.edu).

Anita Blom

**Last year a researcher talked about studies where stuttering is measured by the amount of stuttered syllables. Is that still common? (Please say No...)**

### Scott Yaruss

Hi Anita – oh yes, I have much to say about this. Many people do still measure the observable behavior of stuttering and quantify severity based on a listener's perception. I personally feel that those measures are overused and over-valued. I don't think that they are objective at all, and I truly don't think that there is a need to do this, now that we know how tenuous these measures are. Some on the panel disagree with me on this, and that's okay.

There are also other means of measuring severity. In my opinion, the most important severity measure is a self-rating of severity, and more and more studies are using those. I am presently validating a new severity measure that I hope to release before the year is out. I have a bit of work to go, but it is based on the speaker's experiences, not the listener's perceptions, which have long been known to be of low reliability and questionable validity. Again, this is a point of contention, but this is my thought on the matter.

Rossanna Portley

**Hey Scott. Glad to see you always We must wear our masks to flatten the COVID-19 curve. Is anyone looking at or remarking on any possible impact of wearing masks (placing a mask across the nose and mouth) on 2 year-olds with beginning or normal disfluencies while you they're learning language and speaking or on preschoolers who may be beginning to stutter? It seems to me that the mask could be just one more thing in the way of speaking (and breathing) freely; may depend on the child (temperament and such), how the adult presents it, etc. Just seems to me that for some very young children it might almost feel like someone placing their hand over their mouths, esp if child is not prepared. I feel like I empathize with the experience and how this mask may feel to, say a 2 y/o. This is not a genetics question necessarily, except that the parent of a two year old in my mind is a PWS. Could be helpful if recommendations from all fluency organizations and ASHA could be provided to major organizations for daycares. Thoughts from you, Dr. Sheikbahai, or anyone?"**

### Scott Yaruss

Hi Rossanna – Thanks for the email and for joining the session. It's always nice to see your name! I'm afraid that I don't know of any research on the topic, and I'm not even sure how we'd assess that. To be sure, there appear to be some differences in

temperament and reactivity in some children who stutter, and that might lead to difficulties with tolerating the mask early on. A lot depends upon how it's presented. Unfortunately, right now, the whole issue is so filled with controversy that I wouldn't even know where to begin. Sorry.

Colleen Stoyas

**Dr Yaruss - could wearable devices be used to track stuttering IRL ?**

### Scott Yaruss

Indeed, that's exactly what my newly funded NIH grant will be doing. We are going to look at the differences between stuttering in the real world vs. in the clinical/laboratory setting. Believe it or not, there are no published studies in the field based on samples collected in the real world – all are contrived samples that we know don't reflect people's real experiences. That applies to every single frequency count, severity measure, SSI, observer-based rating – every one of them! We know that they're not necessarily representative of the person's real experiences, yet people take them anyway and presume that they mean something. My goal is to change that. I have a lot of work to do to make it happen, but that's the goal.

Viv Sherry

**So, I have aquired my stutter at the start of march, i am really struggling to get my head around it, and although I know I have had high anxiety for 2 years, possibly caused by ptsd, my gp is a decent that my stuttering is caused by anxiety. please can you point me in the direction to prove either way if she is correct?**

### Scott Yaruss

Hi Viv – I would recommend that you reach out to [Dr. Maguire directly](#).

Fa

**Any studies on alternative medication such as Mushrooms, etc?**

### Gerald Maguire

We do have anecdotal reports of psilocybin, the active ingredient in psychoactive mushrooms, to reduce stuttering. If the FDA allows us to conduct this research with psilocybin, my team is poised to go forth. You must know that the use of psilocybin is against federal law.

Meggan Noggle

**Would any of the pharmacological treatments be more or less indicated across presumed etiologies of stuttering? In other words, would a particular medication be a more viable treatment option for those who stutter with (for example) a neurogenic etiology? Thanks in advance!**

## **Gerald Maguire**

We are investigating, yes. I have published on the use of medications in acquired stuttering. It really depends on the etiology.