Dr. Jennifer Jo Brout established The International Misophonia Research Network (IMRN) in 2015 in order to facilitate cross-disciplinary research. Disappointed by her own experiences with the state of the field when seeking help for her own child in 1999, Dr. Brout began efforts to establish better research practice, improved diagnosis, and innovative clinical practice related to individuals with difficulties processing sensory information, with a particular focus on auditory over-responsivity. Dr. Brout established the Sensation and Emotion Network, SENetwork, in 2007, and founded the Duke Sensory Processing and Emotion Regulation Program at Duke University in 2008. The Sensory Processing and Emotion Regulation Program was renamed the Misophonia and Emotion Regulation program in 2015.

Dr. Brout is a New York State Certified School Psychologist, a Connecticut Professional Licensed Counselor, and holds a Doctorate in School/Clinical-Child Psychology. She graduated from New York University, Columbia University, and Ferkauf School of Psychology (at Albert Einstein School of Medicine) respectively. She is also the mother of adult triplets, and is a Misophonia sufferer herself.

This Booklet Includes

- SENetwork studies, conferences, and symposiums that contribute to understanding misophonia
- IMRN Education, Advocacy, and Research that has aided sufferers and their loved ones in dealing with the disorder
The Misophonia and Emotion Regulation Program is the longest standing research program involved with The International Misophonia Research Network. Founded by Jennifer Jo Brout in 2008, and led by Dr. Rosenthal, research conducted within this program investigates the relationship between auditory over-responsivity/Misophonia and emotions, cognition and behavior. Previous studies from this program have examined the effects of meclizine on pre-pulse inhibition (Levin et al., 2014) and the relationship between sensory over-responsivity and emotions in adult psychopathology (Rosenthal et al., 2011; Rosenthal et al., 2016). Research funded by the Wallace Research Foundation has helped us begin to explore the relationships among sensory processing impairments and difficulties such as misophonia with emotional functioning in adults. In addition to research, we are dedicated to developing, evaluating, and establishing best practices for providers working with people who report having Misophonia. The approach we are developing is multi-disciplinary and is done in tandem with patients and their families. The self-help component to this approach is a practical combination of proactive coping skills designed to help individuals identify aversive stimuli and learn different ways to help calm the physiological and emotional over-arousal associated with that stimuli. The program also seeks to help individuals re-evaluate and change ways of thinking about aversive stimuli that may inadvertently exacerbate, rather than help calm, the physiological and emotional responses.

Misophonia Literature Review Recently Published with IMRN Associates

**Investigating Misophonia: A Review of the Empirical Literature, Clinical Implications, and a Research Agenda**

**Abstract**

Misophonia is a neurobehavioral syndrome phenotypically characterized by heightened autonomic nervous system arousal and negative emotional reactivity (e.g., irritation, anger, anxiety) in response to a decreased tolerance for specific sounds. The aims of this review are to (a) characterize the current state of the field of research on misophonia, (b) highlight what can be inferred from the small research literature to inform treatment of individuals with misophonia, and (c) outline an agenda for research on this topic. We extend previous reviews on this topic by critically reviewing the research investigating mechanisms of misophonia and differences between misophonia and other conditions. In addition, we integrate this small but growing literature with basic and applied research from other literatures in a cross-disciplinary manner.

Relevant Research

Reactivity to Sensations in Borderline Personality Disorder: A Preliminary Study (Abstract)

Individuals with borderline personality disorder (BPD) are widely considered to have problems with emotional reactivity. However, the specific kinds of stimuli that are associated with heightened emotional reactivity in BPD have not been well characterized. Thus, it is unclear whether the emotional dysfunction in BPD occurs in response to any emotionally evocative stimuli, or to specific classes of stimuli. In this study, we used subjective measures (self-report and interview-based) to compare reactivity to sensations (auditory, gustatory, olfactory, tactile, visual) between participants with BPD (n = 30) and healthy controls (n = 50). Controlling for trait negative emotional reactivity, individuals with BPD reported being significantly more reactive across sensory stimuli. However, the difference between controls and BPD was significantly greater for reactivity to auditory stimuli compared to other sensory stimuli. Findings from this study provide preliminary data suggesting individuals with BPD may be characterized by heightened self-reported reactivity to aversive sounds.


Effects of unexpected changes in visual scenes on the human acoustic startle response and prepulse inhibition (Abstract)

Prepulse inhibition (PPI) refers to the process wherein startle responses to salient stimuli (e.g., startling sound pulses) are attenuated by the presentation of another stimulus (e.g., a brief prepulse) immediately before the startling stimulus. Accordingly, deficits in PPI reflect atypical sensorimotor gating that is linked to neurobehavioral systems underlying responsivity to emotionally evocative cues. Little is known about the effects of changes in visual contextual information in PPI among humans. In this study, the effects of introducing unexpected changes in the visual scenes presented on a computer monitor on the human auditory startle response and PPI were assessed in young adults. Based on our animal data showing that unexpected transitions from a dark to a light environment reduce the startle response and PPI in rats after the illumination transition, it was hypothesized that novel changes in visual scenes would produce similar effects in humans. Results show that PPI decreased when elements were added to or removed from visual scenes, and that this effect declined after repeated presentations of the modified scene, supporting the interpretation that the PPI reduction was due to novel information being processed. These findings are the first to demonstrate that novel visual stimuli can impair sensorimotor gating of auditory stimuli in humans.


Meclozine Enhancement of Sensorimotor Gating in Healthy Male Subjects with High Startle Responses and Low Prepulse Inhibition (Abstract)

Histamine H1 receptor systems have been shown in animal studies to have important roles in the reversal of sensorimotor gating deficits, as measured by prepulse inhibition (PPI). H1-antagonist treatment attenuates the PPI impairments caused by either blockade of NMDA glutamate receptors or facilitation of dopamine transmission. The current experiment brought the investigation of H1 effects on sensorimotor gating to human studies. The effects of...
the histamine H1 antagonist meclizine on the startle response and PPI were investigated in healthy male subjects with high baseline startle responses and low PPI levels. Meclizine was administered to participants (n=24) using a within-subjects design with each participant receiving 0, 12.5, and 25 mg of meclizine in a counterbalanced order. Startle response, PPI, heart rate response, galvanic skin response, and changes in self-report ratings of alertness levels and affective states (arousal and valence) were assessed. When compared with the control (placebo) condition, the two doses of meclizine analyzed (12.5 and 25 mg) produced significant increases in PPI without affecting the magnitude of the startle response or other physiological variables. Meclizine also caused a significant increase in overall self-reported arousal levels, which was not correlated with the observed increase in PPI. These results are in agreement with previous reports in the animal literature and suggest that H1 antagonists may have beneficial effects in the treatment of subjects with compromised sensorimotor gating and enhanced motor responses to sensory stimuli.


Emotional reactivity to personally-relevant and standardized sounds in borderline personality disorder (Abstract)

Theoretical conceptualizations highlight emotional reactivity as a core problem for borderline personality disorder (BPD); however, empirical work investigating emotional reactivity in BPD has produced mixed and inconclusive findings. The current study aimed to clarify emotional reactivity in adults diagnosed with BPD (N = 22) and healthy controls (HCs; N = 31) using a controlled, laboratory experiment that assessed multiple indices of emotional reactivity (i.e., subjective, psychophysiological, and facial expressive) in response to auditory stimuli (i.e., standardized vs. personally-relevant; pleasant vs. unpleasant sounds). The BPD group was characterized by higher self-reported arousal and lower valence to personally-relevant unpleasant sounds compared to HCs. Supporting study hypotheses, participants in the BPD group showed heightened skin conductance responses, specifically to unpleasant personally-relevant sounds, compared to HCs. No differences were found between BPD and HC groups on facial expressive responses. Findings replicate and extend previous studies on this topic, and highlight the need to further refine the characterization of emotional reactivity in BPD to include personally-relevant unpleasant stimuli.


Sensory over-responsivity in adults with autism spectrum conditions (Abstract)

Anecdotal reports and empirical evidence suggest that sensory processing issues are a key feature of autism spectrum conditions. This study set out to investigate whether adults with autism spectrum conditions report more sensory over-responsivity than adults without autism spectrum conditions. Another goal of the study was to identify whether autistic traits in adults with and without autism spectrum conditions were associated with sensory over-responsivity. Adults with (n = 221) and without (n = 181) autism spectrum conditions participated in an online survey. The Autism Spectrum Quotient, the Raven Matrices and the Sensory Processing Scale were used to characterize the sample. Adults with autism spectrum conditions reported more sensory
over-responsivity than control participants across various sensory domains (visual, auditory, tactile, olfactory, gustatory and proprioceptive). Sensory over-responsivity correlated positively with autistic traits (Autism Spectrum Quotient) at a significant level across groups and within groups. Adults with autism spectrum conditions experience sensory over-responsivity to daily sensory stimuli to a high degree. A positive relationship exists between sensory over-responsivity and autistic traits. Understanding sensory over-responsivity and ways of measuring it in adults with autism spectrum conditions has implications for research and clinical settings.


Sensory reactivity, empathizing and systemizing in autism spectrum conditions and sensory processing disorder (Abstract)

Although the DSM-5 added sensory symptoms as a criterion for ASC, there is a group of children who display sensory symptoms but do not have ASC; children with sensory processing disorder (SPD). To be able to differentiate these two disorders, our aim was to evaluate whether children with ASC show more sensory symptomatology and/or different cognitive styles in empathy and systemizing compared to children with SPD and typically developing (TD) children. The study included 210 participants: 68 children with ASC, 79 with SPD and 63 TD children. The Sensory Processing Scale Inventory was used to measure sensory symptoms, the Autism Spectrum Quotient (AQ) to measure autistic traits, and the Empathy Quotient (EQ) and Systemizing Quotient (SQ) to measure cognitive styles. Across groups, a greater sensory symptomatology was associated with lower empathy. Further, both the ASC and SPD groups showed more sensory symptoms than TD children. Children with ASC and SPD only differed on sensory under-reactivity. The ASD group did, however, show lower empathy and higher systemizing scores than the SPD group. Together, this suggest that sensory symptoms alone may not be adequate to differentiate children with ASC and SPD but that cognitive style measures could be used for differential diagnosis.

Dr. Jennifer Jo Brout sponsored The Sensation to Emotion Conference, with advisement and support from Dr. Zachary Rosenthal, Dr. Joseph E. LeDoux and Dr. Lucy Jane Miller. The conference brought together scholars and clinicians across disciplines in order to advance the understanding of how sensory processing and emotion regulation interact, and how these processes affect human behavior. Both days of the conference featured panel discussions about basic and applied research, as well as presentations and clinical therapy workshops. We explored the neurobehavioral processes underlying the emotions often associated with a high reactivity level to sensory information, with a particular focus on auditory stimuli.

Opening Address: Sensation to Emotion
Joseph E. LeDoux
New York University Center for Neural Science

Emotional Processing and Regulation in the Human Brain
Elizabeth Phelps, Ph.D.
New York University Department of Psychology

Sensory Responsivity and Emotion Regulation in Personality Disorders
M. Zachary Rosenthal, Ph.D.
Duke University Medical Center

Validating Music Therapy through Emerging Neuroscience Research
Concetta M. Tomaino, D.A., MT-BC, LCAT
Institute for Music and Neurologic Function at Beth Abraham

How the Brain Develops Ability to Integrate Information From Different Senses to Guide Overt Behavior
Barry E. Stein, Ph.D.
Wake Forest University

Multidisciplinary Panels
Multidisciplinary Panel Discussions included a range of relevant topics. Panels on issues affecting children and adults included discussion on the impact of sensory over responsiveness on attachment, psychiatric and developmental disorder.

For comprehensive information https://www.sensationandemotionnetwork.com/sensation-and-emotion-conference.html
In 2015 Drs. Jennifer Jo Brout and M. Zachary Rosenthal brought together academic researchers and clinicians for a symposium. By this time, Misophonia was covered extensively in the public press, although the research was only beginning. This began with a popular press articles discussing the difference between misophonia and hyperacusis. As a result of the press coverage, Internet support groups emerged in the United States, the U.K., Australia, and more. Discussions involved underlying processes related to children and adults who had auditory sensitivities across various medical, developmental and mental health disorders. This was followed by a group discussion focused on potential collaborations and funding possibilities related specifically to misophonia.

Sensory Processing and Emotion Regulation
Basic Processes & Treatment
February 10th, 2015 1-5 pm

This symposium was a combined effort between SENetwork and the Duke Sensory Processing and Emotion Regulation Program.

Participants

- Helen Egger M.D., Duke University Medical Center
- Joseph LeDoux Ph.D., The LeDoux Lab (Center for Neural Studies at NYU)
- Edward D. Levin, Ph.D., Duke University Medical Center
- Dean McKay, Ph.D., ABPP, Fordham University of New York
- Stephen W. Porges, Ph.D., University of North Carolina at Chapel Hill
- Frank L. Rice, Ph.D., President and Chief Scientist, Integrated Tissue Dynamics
- M. Zachary Rosenthal, Ph.D., Duke University Medical Center
- Barry Stein, Ph.D., Wake Forest University
- Teresa Tavassoli, Ph.D., Mount Sinai Hospital
- Nancy Zucker, Ph.D., Duke University Medical Center
- Jennifer Brout, Psy.D., SENetwork/International Misophonia Research Network

Sponsored by Duke Sensory Processing and Emotion Regulation Program, & The Department of Psychiatry and Behavioral Sciences

Network (IMRN)

- Duke Sensory Processing and Emotion Regulation Program changed to Misophonia and Emotion Regulation Program

  - Began work toward multi-disciplinary management care pathway at Duke University, educational classes/webinars, literature review

  - Continued research on sensory processing issues and emotion regulation, and Misophonia and emotion regulation

- Research Study: Documenting the acoustic features that elicit subjective experiences related to pathogen, predator, danger, and safety (Stephen W. Porges, Ph.D., Distinguished University Scientist at the Kinsey Institute at Indiana University Bloomington and Research Professor at the University of North Carolina at Chapel Hill)

- Research Study: Neural Correlates in the Amygdala of Extreme Responders to Pavlovian Threat Conditioning (Joseph E. LeDoux Lab, N.Y.U)
The IMRN continues to focus on research, advocacy and education in the same spirit that SENetwork did.

IMRN

- Connects researchers directly with misophonia sufferers, as well as their families, so that there is a door open to communication and fundraising
- Provides a platform in which practitioners and researchers may communicate so that academia and clinical practice directly inform each other
- Helps ensure that infant/toddler, childhood, adolescent and adult clinicians/researchers maintain focus on lifespan development

The IMRN helps fund research through crowd sourcing and by facilitating direct connections between researchers and those who are dealing with Misophonia, or who would have an interest in the disorder. IMRN does not accept any donations directly. IMRN works closely with advocate Shaylynn Hayes, a university student and Misophonia sufferer who resides Canada. Misophonia International (MI) started in 2015 alongside IMRN as an advocacy project, information site, and a resource to help bridge the gap between researchers, advocates, and sufferers.

Visit the IMRN website for more information at www.misophonia-research.com
• Dissemination of accurate and current information about misophonia research and clinical practice in accessible language

• Downloads, for medical and mental health professionals, teachers, family members, employers and misophonia sufferers

• Articles that include interviews with researchers and clinicians

• Published books written by those in the misophonia community

• Articles submitted to Ms. Hayes by individuals with misophonia on various topics important to the community

Shaylynn Hayes is a writer, graphic/web designer, and student of Political Science. Shaylynn runs Misophonia International, for which Jennifer Jo Brout serves as Research Director. The site focuses on research, coping, and awareness for the disorder. Shaylynn is actively involved in the web management of Misophonia-Research.com.
MI and IMRN recently created two new website resources

**Misophonia Providers**

www.misophoniaproviders.com

Misophonia Providers is an interdisciplinary network of providers who are both familiar with misophonia and concur with best practice for helping those in need. In order to ensure that our provider list meets with the highest standards of practice, Dr. Jennifer Brout developed a class for Continuing Education Credits which is currently on Drexel University’s website, titled “The Helpers Guide to Understanding Misophonia. It is for clinicians of all disciplines, and these clinicians have participated in and advertised educational webinars for researchers, other clinicians and individuals with misophonia, and their families.

**Misophonia Kids**

www.misophoniakids.com/advisory-board

Misophonia Kids is a resource tailored specifically for parents. Children with misophonia have different needs than adults. For example, school functioning as well as sibling and other family relationships may be negatively impacted, as a result, parents of children with misophonia have different challenges and concerns. This resource addresses these concerns from a developmental perspective.
**Misophonia Literature Review**


Abstract: Misophonia is a neurobehavioral syndrome phenotypically characterized by heightened autonomic nervous system arousal and negative emotional reactivity (e.g., irritation, anger, anxiety) in response to a decreased tolerance for specific sounds. The aims of this review are to (a) characterize the current state of the field of research on misophonia, (b) highlight what can be inferred from the small research literature to inform treatment of individuals with misophonia, and (c) outline an agenda for research on this topic. We extend previous reviews on this topic by critically reviewing the research investigating mechanisms of misophonia and differences between misophonia and other conditions. In addition, we integrate this small but growing literature with basic and applied research from other literatures in a cross-disciplinary manner.

**Neural Correlates in the Amygdala of Extreme Responders the Pavlovian Threat Conditioning**


In this study Dr. Diaz-Mataix separated out rodents according to the level of their over-responsivity to repetitive stimuli. The rodents fell into groups of extreme high responders, high responders, typical responders and low-responders. That means, that even in rodents there seems to be a range from extreme sensitivity to low sensitivity to repetitive auditory stimuli (just as there seems to be with people). People with misophonia would be like the extreme over-responder rodents.

Results show that extreme-responders are least likely to “un-learn” the association between noxious stimuli and the physiological response (or fight/flight). This study supports:

- This the misophonia symptoms are due to physiological phenomena (i.e. if you can see it rodents who don’t “think” as we do, then we have more evidence that this is not a “psychological problem”

- If “extreme-responders” are similar to those of us with misophonia, and are unable to “unlearn” an associated response between stimuli and an event, then simple exposure therapy is highly unlikely to work

- Given this information, memory reconsolidation may be a promising remediation for misophonia symptoms

See poster on the next page (reverse).
Neural Correlates in the Amygdala of Extreme Responders to Pavlovian Threat Conditioning

Lorenzo Diaz-Mataix¹ & Joseph E. LeDoux¹,²

¹Center for Neural Science, New York University, NY, USA; ²The Emotional Brain Institute. Nathan Kline Institute, Orangeburg, NY, USA

Introduction

In Pavlovian auditory Threat Conditioning (PTC), an initially neutral conditioned acoustic stimulus (CS), after being associated with an aversive unconditioned stimulus (US), typically an electric shock, acquires the ability to induce conditioned responses (CR) such as freezing.

The amygdala is essential for this form of associative learning and memory. The CS and the US information converge in the Lateral Nucleus of the Amygdala (LA) cells. On its part, the Central Nucleus of the Amygdala (CeA) regulates conditioned threat responses.

Most of what is known about PTC and its underlying brain circuitry is based on experiments in which the data is analyzed by averaging measures of different individuals. However, there is great variability on individual conditioned responses.

The use of central tendency measures assumes population homogeneity, and therefore is potentially overlooking the neurobiological basis that might explain exaggerated behaviors.

Objectives

• To establish subpopulations of rats based on their individual different reactivity to the Conditioned Stimulus

• To identify potential correlations between phenotype and the neural activity in LA and Ce

• To identify molecular or and electrophysiological markers of different reactivity

Methods

Figure 1: Time-evolved field potential in the Lateral Nucleus of the Amygdala shows higher potentiation in the animals naturally exhibiting high freezing responses to the conditioned stimulus compared with the low freezers. Example traces of one animal belonging to the high freezers group (A) and to the low freezers (B) during baseline (left graph of each panel) and during Long-Term Memory test (right graph of each panel).

Figure 2: Three distinct behavioral phenotypes are found after performing an Unsupervised hierarchical cluster analysis based on Euclidean distances between the average amount of freezing during LTM test of each individual. A) Dendrogram constructed from the Euclidean distance matrix. Height Ratio: 73.9% B) Scatter Plot with depicting the 3 clusters in the space.

Figure 3: When memory is tested 48 hours after conditioning, the 3 groups show significantly different level of freezing to each CS presentation (A). The extinction rate and the final level of extinction is significantly different depending on the groups (B). A: Two-way ANOVA F(18, 590) = 2.43 p < 0.0009; B: Two-way ANOVA F(2, 118) = 11.69 p < 0.0001

Figure 4: A: Performance on the Acquisition phase of the performance test. B: Performance on the Extinction phase of the performance test.

Conclusions

• Unsupervised data clustering results in 3 clearly different group of animals based on their individual freezing response. Animals showing regular freezing are approximately 70%; 20% exhibit exaggerated freezing while 10% show very low freezing.

• Low-freezers extinguished faster than do regular-freezers. The repeated presentation of 10 CSs is not enough to observe any extinction in the high-freezers.

• There is a differential neural activity in the Lateral Nucleus of the amygdala matching the level of freezing of the high and the low freezers.

• Finding group-related differential neurophysiological characteristics might be key to understand and potentially treat psychiatric conditions characterized by over-responsivity to auditory stimuli.

The authors like to thank Jennifer Jo Brouet, Psy.D. for her intellectual contributions.

This project is being supported by the 4H foundation.
Documenting the acoustic features that elicit subjective experiences related to pathogen, predator, danger, and safety

Stephen W. Porges, Ph.D., Department of Psychiatry, University of North Carolina

The Center for Emotion and Attention at the University Florida developed a database of sounds, the International Affective Digitized Sound system (IADS). The IADS (Bradley & Lang, 2007) provides a set of acoustic stimuli for experimental investigations of emotion and attention. The acoustic stimuli, similar to the visual stimuli that constitute the International Affective Picture System (IAPS), were rated along two primary dimensions: affective valence (ranging from pleasant to unpleasant) and arousal (ranging from calm to excited). Categorizing affective qualities using these dimensions is an empirical approach that does not make any theoretical assumption regarding evolutionary or neurophysiological processes that may contribute to certain sounds triggering subjective responses along the dimensions of affect (valence, arousal) used to quantify the affective qualities of each specific stimulus.

- In contrast to this empirical approach, the Polyvagal Theory makes predictions based on acoustic properties. The Polyvagal Theory proposes that subjective responses to sounds are initially (before associative learning) based on two features of the acoustic signal: pitch and variation in pitch. The theory articulates that for mammals there is a frequency band of perceptual advantage in which social communication occurs. It is within this frequency band that acoustic “safety” cues are conveyed. Consistent with the theory, safety is signaled when the pitch of the acoustic signal is modulated within this band. Thus, a monotone within this band is not sufficient to signal safety. Moreover, the theory proposes that low frequency monotone sounds (e.g., dog's bark, lion's roar, large truck, and thunder) are inherent signals of predator and high frequency monotone sounds are inherent signals of pain and danger (e.g., shrill cries of babies or someone who is being injured).

- The frequency band of perceptual advantage is functionally defined by the physics of the middle ear structures. During the evolutionary transition from ancient reptiles to mammals, the middle ear bones became detached from the jawbone. This functionally enabled mammals to communicate via vocalizations in a frequency band that could not be detected by the ancient reptiles. Operationally, in humans this frequency band functions from about 500 Hz to about 4000 Hz. Within these frequencies, the second and third formant in both male and female human speech always occur and in many cases so does the first formant. Basically, we can’t understand the meaning of speech without processing the formants, and this difficulty is a feature of many individuals with auditory processing difficulties.
The following is a very small preliminary study of adults recruited from Duke Psychiatry clinics. Still, here is what we are finding so far:

- Misophonia symptom severity is related to higher symptoms of anxiety, depression, and general psychological distress. It also is higher among individuals with more psychiatric disorder diagnoses. However, misophonia is not related to any one specific psychiatric disorder. Instead, greater misophonia symptom severity is related to a range of different psychiatric disorders. This may indicate that the symptoms of misophonia occur in various psychiatric disorders and/or that misophonia is a risk factor in personality development and disorders. In addition, these preliminary results suggest that misophonia is not related to any specific psychiatric diagnosis.

- Misophonia symptom severity appears to be related to more general sensory over-responsivity across senses. That is, misophonia severity is associated with higher auditory sensory over-responsivity. However, it is also related to greater over-responsivity to touch, taste, and visual cues. This suggests misophonia may not be uniquely related to sensitivity to sounds.

- Misophonia symptom severity is related to certain personality features, including the general tendency to feel intense negative emotions, emotional instability, and difficulties regulating emotions when upset. However, misophonia was unrelated to general neuroticism or the tendency to have intense positive emotions. This pattern of findings suggests that those with misophonia may not be more “neurotic” or feel all emotions intensely, but may instead have difficulties with emotional intensity, instability, and emotion regulation. Notably, this study does not tell us if the symptoms of misophonia are a result of emotional dysregulation or if they are causal, or both. Likely misophonia is an interaction of both.

- Emotionally related misophonia symptoms include anger, sadness, a feeling of overload, anxiety, disgust, and other responses to trigger sounds. How people regulate these emotions in response to trigger sounds can help with coping skills. To determine the best treatments for misophonia, both neurological and emotional regulation (and ways in which they interact) should be considered.
Follow up to Brain Basis of Misophonia

Collaborators
Sukhbinder Kumar, Mercede Erfanian (in progress)

In our previous fMRI study (Kumar et al., 2017, Current Biology) we identified the brain areas, which are hyperactive (compared to controls) in response to trigger sounds in participants with misophonia. However, because fMRI ‘slow’ in measuring the brain activity, it cannot measure the moment-by-moment changes (dynamics). The aim of the present study is to determine the dynamics of the brain activity, using electroencephalography (EEG) or magnetencephalography (MEG). One advantage of measuring this activity is that it is relatively less expensive than fMRI, and may be useful for therapeutic purposes.

Deconstructing typical misophonia sounds: What characteristics do these sounds have in common?

Collaborators:
Jennifer Jo Brout, Mercede Erfanian, Christiana Kartsonaki, Sukhbinder Kumar, Michael Mannino, M. Zachary Rosenthal

Clinicians and researchers familiar with misophonia continue to puzzle over the reasons sufferers typically report being triggered by the same sounds. These sounds are typically pattern-based, or repetitive, and often come from people or animals (but also include non-organic sounds such as motors). Common examples of person-emanated sounds include breathing, sniffing, chewing, throat clearing, and pencil tapping.

- Using advanced software, we are analyzing the acoustic properties of these sounds, including frequency/pitch, repetition, and frequency modulation. The results of the proposed study will aid in determining the elements of each sound that acoustically differentiates misophonic sounds from other auditory stimuli, and what trigger sounds have in common.

Nemours Pediatric Hospital: Ultra-High Frequency Research

Jenna Pellicori, Tammy Reigner, Yell Inverso

These researchers/clinicians are working to obtain normative data for ultra-high frequency hearing sensitivity in the pediatric population. Typically, audiologists do not test above 8000 Hz for routine audiometric evaluations. Nonetheless, we are born with a range of hearing from 20 Hz to 20,000 Hz. Research has shown that just from hearing everyday sounds without insult, we often begin to lose ultra-high frequency hearing sensitivity early on.

The high frequencies are most vulnerable because of the tonotopic organization of the cochlea (inner ear), which contains cilia responsible for high frequency hearing at the base of the cochlea, and low frequency hearing at the apex of the cochlea. The more apical parts of the cochlea are less frequently exposed to damaging sounds, while the base of the cochlea is exposed to all sounds that are picked up by the inner ear.

These clinical researchers noticed abnormally good high frequency hearing sensitivity in Misophonia patients. The extended high frequencies appear to be extremely sensitive in these patients, more so than in typical adolescence. Unfortunately, normative data in the ultra-high frequency range is antiquated for the pediatric population, so the Neumors group is working to re-establish norms in children with normal peripheral hearing and no auditory complaints, as well as in children with diagnoses of auditory disturbances such as Misophonia, Tinnitus, and Hyperacusis.

This will allow for a comparison of ultra-high frequency hearing sensitivity in patients with and
without specific auditory disturbances to see if there is a significant correlation. Once this information is obtained, it would be interesting to see if common trigger sounds contain acoustic properties within the range of ultra-high frequency hearing using spectral analysis.

Cortical Auditory Evoked Potential & OAE Suppression Evaluation

Using a small sample size, the Neumors group conducted electrophysiologic measures on children diagnosed with Misophonia and found that they all have some extent of abnormal cortical auditory evoked potentials and/or Otoacoustic Emission Suppression measures. The Cortical Auditory Evoked Potential Evaluation reveals how the auditory system is functioning starting at the ear and ending at the auditory cortex. The OAE Suppression Testing evaluates an efferent motor pathway in the medial-olivary complex designed to suppress ambient noise. In some individuals instead of suppressing noise, this system abnormally increases noise, which can result in children feeling overwhelmed and sensitive or distracted by background noise and auditory information.

The Nemours group hopes to gather a larger sample size in order to test this finding. This may provide physiologic evidence of a cortical abnormality in the auditory cortex which may suggest that the etiology of Misophonia may be earlier in the temporal lobe than originally thought (and may not be limited solely to the limbic system. This would be a pretty remarkable finding considering the limbic system and auditory cortex both reside within the temporal lobes.

Memory reconsolidation: Possible implications for treatment of misophonia, IMRN - TBA

We know that in Misophonia autonomic nervous arousal (fight/flight system) occurs in response to specific sounds. The fight/flight response is mediated by a part of the brain called the amygdala. At the LeDoux lab at NYU Joseph LeDoux and his colleagues have been studying the amygdala for decades. They have done groundbreaking work in this part of the brain that mediates fight/flight, and is also involved in neural processes related to memory related to fear.

The amygdala is also involved with memory. In terms of misophonia (regardless of age of onset) individuals make memories in which the body’s fight/flight response is associated with particular sounds. In addition, some of us may be born with a higher arousal system, or may simply be more sensitive to auditory stimuli. Therefore, some of us may be more vulnerable to forming these memories.

Once these memories are formed, they are similar to trauma memories as nervous system arousal is activated within milliseconds in response to a cue (although in Misophonia there is no specific traumatic event).

In an analysis of the auditory stimuli that are most noxious to people with misophonia, repetition is a common characteristic. Normally, in order to test how these memory associations are made, the rodent sample used is tested in a typical learning paradigm. That is, the rodent is “taught” to associate a sound with an unpleasant stimulus. Then the situation is reversed, and the rodent eventually unlearns this response (or extinguishes).

Dr. LeDoux has been working on the ability to reverse these associated memories for many years. He has done so in the realm of “basic science”. Basic neuroscience strives to look at specific brain processes that may then inform typical and atypical populations and therefore numerous disorders.

Because typical exposure therapy and therapies that have relied upon re-associating stimuli with events or other stimuli generally do not show results
that are long lasting for disorders such as PTSD, or even phobias, LeDoux has looked for other ways in the brain to change the association between the automatically activated threat response once it has been associated with a particular stimuli. This is a process called memory re-consolidation. Believe it or not, each time we retrieve a memory from our long-term memory system it alters slightly. This is something LeDoux’s lab discovered early in the millennium. This is contrary to prior ideas about memory in which scientists thought that once a memory was formed it was stable and always retrieved as the exact same memory.

Using memory reconsolidating LeDoux and colleagues have already proven that the automatic physiological response to a stimuli (or a memory in regard to sound in misophonia) can be changed in simple ways. Whereas most behavior therapists rely on exposure to aversive stimuli in order to desensitize people to trauma (in this case a noise, pattern of sound, or repeating noise) or to relearn an association between a sound and a particular person, etc. they are often unable to obtain results, and if they do obtain results, they don’t last. This is because of memory.

Dr. Díaz-Mataix separated, at the LeDoux Lab, separated out rodents according to the level of their over-responsivity to repetitive stimuli. The rodents fell into groups of extreme high responders, high responders, typical responders and low-responders. That means, that even in rodents there seems to be a range from extreme sensitivity to low sensitivity to repetitive auditory stimuli (just as there seems to be with people). People with misophonia would be like the extreme over-responder rodents. Results show that extreme-responders are least likely to “un-learn” the association between noxious stimuli and the physiological response (or fight/flight). This study supports:

• This the misophonia symptoms are due to physiological phenomena (i.e. if you can see it rodents who don’t “think” as we do, then we have more evidence that this is not a “psychological problem”

• If “extreme-responders” are similar to those of us with misophonia and are unable to “unlearn” an associated response between stimuli and an event, then simple exposure therapy is highly unlikely to work

• Given this information, memory reconsolidation research may contribute to potential Misophonia interventions
Webinars

**When Sounds Trigger Sound Reactions: Misophonia Research and What You Can Do**
*October 27th, 2016*

Description: This inaugural webinar hosted by Jennifer Jo Brout, Ed.M., Psy.D & M. Zachary Rosenthal, Ph.D. brought together two nationally recognized speakers to discuss the most recent advances in our understanding of misophonia (also known as auditory over-responsivity).

This included:
- Defining Misophonia and its symptoms
- Misophonia research and what science tells us
- The relationship between misophonia and emotions, cognition and behavior
- What you can do if you or your loved one suffers from Misophonia

**An Overview of Misophonia with Drs. Kumar, Brout, and Rosenthal**
*May 5th, 2017*

An Overview of Misophonia: Latest Research and Q&A with Dr. Sukhbinder Kumar

Description: This webinar reviewed emerging concepts of the underlying mechanisms of misophonia. In addition, there was an extended question and answer session with Dr. Sukhbinder Kumar, who addressed his recent study The Brain Basis for Misophonia published in Current Biology February 2017.

**Multidisciplinary Management of Misophonia:**
*March 26, 2018*

Drs. Jennifer Brout (IMRN) & Zach Rosenthal (Duke University’s Dept. of Psychiatry & Behavioral Sciences) lead a two hour online educational class involving a multidisciplinary team of individuals who work with misophonic cases in their specialized areas of expertise. This WebEx class was geared towards individuals with misophonia (strong negative reactions to sounds), loved ones or parents of an individual with misophonia or even providers of those who suffer with misophonia.

This class was offered online via WebEx and included discussion with the team that includes clinical psychologists, audiologists, and an occupational therapist. No clinical education credits were being provided since the class was primarily directed towards misophonic individuals and/or those who know someone struggling with misophonia (e.g. spouses, parents and other loved ones). This class allowed for questions from attendees over the phone or via the WebEx portal.

Link:
Using narrated PowerPoint slides and a podcast-style interview, “The Helper’s Guide to Understanding Misophonia” is a 2.5-hour long continuing education course* that aims to provide an introduction to misophonia for clinicians. Though the term literally means “hatred of sounds,” it is best characterized as a neurophysiological disorder with emotional, cognitive and behavioral components - often resulting in affective distress. Misophonia causes individuals to experience aversive reactivity to certain pattern-based sounds that most people would find innocuous. As this under-researched disorder becomes more popularized in the press, clinicians should be prepared to encounter clients of all ages who suffer from this disorder. Unfortunately, no evidence-based treatment yet exists for misophonia, however through this course clinicians will begin to learn the strategies they can use to help clients learn about and cope with their sound sensitivity.

*This course is generously delivered by a special guest presenter, Dr. Jennifer Jo Brout, who is recognized internationally as a driving force for increasing our knowledge base about misophonia. Dr. Brout has been at the forefront of research in this area for the past two decades, having established the Sensation and Emotion Network (SENetwork) in 2007, along with the Sensory Processing and Emotion Regulation Program at Duke University in 2008. Dr. Brout is also the founder of the International Misophonia Research Network, and is the research director for the news and advocacy website, Misophonia International.
IMRN Advisory Board

The IMRN Advisory Board consists of researchers of a variety of disciplines, including audiologists, neuroscientists, psychiatrists, psychologists, occupational therapists, and others.

Jennifer Jo Brout, Psy.D.

Jennifer Jo Brout is the Director of the International Misophonia Research Network. She is a New York State Certified School Psychologist, a Connecticut Professional Licensed Counselor, and holds a Doctorate in School/Clinical-Child Psychology. Disappointed by her own experiences with the state of the field when seeking help for her own child in 1999, Dr. Brout began efforts to establish better research practice, improved diagnosis, and innovative clinical practice related to auditory over-responsivity. Dr. Brout has been at the forefront of research in this area for over 18 years, having established the Sensation and Emotion Network (SENetwork) in 2007, along with Sensory Processing and Emotion Regulation Program at Duke University in 2008 (now the Misophonia and Emotion Regulation Program. She graduated from New York University, Columbia University, and Ferkauf School of Psychology (at Albert Einstein School of Medicine) respectively. She is also the mother of adult triplets, and is a Misophonia sufferer herself. For more about Jennifer Jo Brout, and her publications please see https://www.sensationandemotionnetwork.com/dr-brout-publications.html

Miren Edelstein, M.A., Ph.D. Can.

Miren Edelstein is a doctoral candidate in the UCSD Psychology Department’s Center for Brain & Cognition studying under Dr. Diana Deutsch and Dr. V.S. Ramachandran. She received my BA in Psychology with a minor in music from UC Berkeley in 2011. Her research interaests include music cognition, absolute pitch, synesthesia, auditory perception and misophonia. For Ms. Edelstein’s publications, please see https://www.researchgate.net/profile/Mirenedelstein
Melanie Herzfeld, Au.D.

EDUCATION: BA, Speech with Honors, Lehman College (formerly Hunter College, Bronx Campus), Bronx, NY January 1971
MA, Audiology, Queens College, January 1975
Audiology Doctorate, December 2000, Central Michigan University

PROFESSIONAL EXPERIENCE: July 2003 to present, private practice, Melanie Herzfeld, Au.D., Audiologist, PC, 113 Crossways Park Drive, Suite 101, Woodbury, NY Dr. Herzfeld provide complete audiological assessments for all ages, including Tinnitus evaluations and treatments, Auditory Processing Disorder tests, and Hearing Aid dispensing. For more about Dr. Herzfeld http://www.earminder.com/
Lorenzo Diaz-Mataix, Ph.D.

Lorenzo Diaz-Mataix received his PhD at the University of Barcelona, Spain. He is currently a Research Assistant Professor in the Center for Neural Science at New York University, where he has worked in the laboratory of Professor Joseph LeDoux since 2006. He is interested in the study of basic neurophysiology and neuropharmacology underlying emotional learning and memory. In particular, his studies take a translational approach, asking basic questions that have potential clinical implications. He has been a visitor scientist at Université Paris XI/CNRS in France, and at the Riken Brain Science Institute in Japan. He was a Fulbright Post-doctoral scholar and a travel awardee of the American College of Neuropsychopharmacology. He is also the recipient of a NARSAD Young Investigator Award to study drugs with a potential prophylactic effect on the development of PTSD after a traumatic experience. For full publication list, [http://nyu.academia.edu/LorenzoD%C3%ADazMataix](http://nyu.academia.edu/LorenzoD%C3%ADazMataix)

Ali A. Danesh, Ph.D.

Ali A. Danesh, Ph.D., CCC-A, FAAA, is currently a Professor at the Department of Communication Sciences and Disorders, and also has a Secondary appointment as Professor of Biomedical Sciences in the Charles E. Schmidt College of Medicine, Florida Atlantic University (FAU), Boca Raton, Florida Dr. Danesh teaches courses in neuroanatomy and neurophysiology of auditory and vestibular systems, audiology, genetics of communicative disorders, and aural rehabilitation. He also supervises graduate students at the FAU Communication Disorders Clinic.Dr. Danesh’s research interests include tinnitus, hyperacusis, misophonia, auditory evoked potentials, auditory responses in both normal and pathological populations, vestibular assessment, and diagnostic/rehabilitative audiology. Dr. Danesh obtained his B.Sc. in audiology from Iran University of Medical Sciences, Tehran, Iran, his M.S. in audiology from Idaho State University, Pocatello, Idaho, and his Ph.D. in audiology, with an emphasis on auditory electrophysiology, from the University of Memphis, Memphis, Tennessee. Dr. Danesh is an American Board of Audiology board certified practicing audiologist. His current clinical work concentrates on patients with tinnitus, vertigo and sound sensitivity (e.g., hyperacusis and misophonia). Dr. Danesh has presented in many scientific conventions and has published in numerous professional and scientific journals. For Dr. Danesh’s full publication list please see [https://labyrinthaudiology.com/audiologist](https://labyrinthaudiology.com/audiologist)
IMRN Advisory Board

Mercede Erfanian, IMRN Research Associate

Mercede Erfanian has a background in clinical psychology (BSc) and neuroscience (MSc) with particular focus on affective disorders. Her research concerns understanding brain mechanisms in patients with mood and anxiety disorders. At the moment her research focus is specific to Misophonia, its brain mechanisms, cognitive and emotional characteristics and co-morbidity with other affective disorders. She has published many scientific papers and is the winner of several international prizes (e.g. Herman Westenberg Prize) and grants (e.g. IBRO-FENS grant). For Ms. Erfanian’s publications https://www.researchgate.net/profile/Mercedeefranian2

Margaret M. Jastreboff, Ph.D.

Dr. Margaret M. Jastreboff received her Ph.D. in Biological Sciences from the Polish Academy of Sciences (1982), and postdoctoral training in pharmacology and molecular biology at Yale University School of Medicine. She has been involved in tinnitus research since 1984, and on a full-time basis since 1991 while working at University of Maryland School of Medicine. Her experimental work encompassed the study of the mechanisms of tinnitus using molecular biology, pharmacology, and behavioral techniques, including testing drugs for their effectiveness for tinnitus attenuation. She has been involved in clinical work for over 15 years as well, while working first as an Associate Professor at Emory University and later as a Visiting Research Professor at Towson University and currently in a clinic of non-profit foundation. After over 35 years in academia, where she was involved in basic science and clinical research, teaching Au.D. students and treating patients, she become a President of JHDF, Inc., a non-profit foundation dedicated to research and education in the field of tinnitus and decreased sound tolerance as well as treating patients. She organized and was one of the lecturers in 40 courses on Tinnitus Retraining Therapy in the USA and close to 100 courses abroad. She is a co-author of over 65 papers and 100 abstracts. In 1993 she shared with Dr. Pawel J. Jastreboff the Robert W. Hocks award for her contribution to the field of tinnitus. For Dr. Jastreboff’s publication list https://scinapse.io/authors/1930453827
IMRN Advisory Board

Pawel Jastreboff, Ph.D., Sc.D., M.B.A.
Dr. Jastreboff is currently Professor at Department of Otolaryngology, Emory University School of Medicine. After 8 years at Yale University and 8 years at the University of Maryland, where he established the first Tinnitus & Hyperacusis Center in the USA, he moved to Emory University. In 1984 he proposed the first accepted animal model of tinnitus, in 1988 the neurophysiological model of tinnitus and Tinnitus Retraining Therapy (TRT). He is involved in clinical work and treating patients with tinnitus and/or decreased sound tolerance since 1990. Simultaneously with clinical work he has been conducting basic science and clinical research aimed at delineating the mechanisms of tinnitus and designing new methods of alleviation of tinnitus, hyperacusis and misophonia. In 2001, together with Margaret M. Jastreboff, Ph.D., he proposed the concept, name and initial treatment for misophonia. Dr. Jastreboff received a Ph.D. in Neurophysiology (1973) and Doctor of Sciences Degree (habilitation, 1982) in Neuroscience from the Polish Academy of Sciences. He did his Postdoctoral training at the University of Tokyo, Japan. In 2005 he received M.B.A. (valedictorian) from Goizueta Business School at Emory University. He has been a Visiting Professor at University of Tokyo and at Yale University and currently holds Visiting Professor appointments at University College London and Middlesex Hospital, London, England. From 2001 until 2010, together with Margaret M. Jastreboff, Ph.D., he has been Adjunct Professor at Salus University teaching tinnitus and hyperacusis class in the Au.D. program. 1,954 audiologists (about 25% of all Au.D. degrees in the USA) took this class. He is a co-author of over 130 papers, 170 abstracts and three books. In 1993 he received the prestigious Robert W. Hocks award for his contribution to the field of tinnitus and in 2014, at the 11th International Tinnitus Seminar, the Award for Clinical Excellence, for 25 years work of TRT. For Dr. Jastreboff’s publication please see, http://otolaryngology.emory.edu/research/index.html

Christiana Kartsonaki, DPhil
Christiana Kartsonaki is a Senior Statistician at the MRC Population Health Research Unit in the Clinical Trial Service Unit and Epidemiological Studies Unit (CTSU), Nuffield Department of Population Health, University of Oxford. She has a degree in Mathematics, an MSc in Applied Statistics and a DPhil in Statistics. She has previously worked in the Department of Oncology of the University of Oxford and at the Centre for Cancer Genetic Epidemiology in the Department of Public Health and Primary Care of the University of Cambridge. For more about Ms. Kartsonaki’s work please see https://www.medsci.ox.ac.uk/study/graduateschool/supervisors/christiana-kartsonaki
Dr. Sukhbinder Kumar is a neuroscientist and is currently working as a Research Fellow at Wellcome Trust Centre for Neuroimaging, University College London (UCL) and Institute of Neuroscience, Newcastle University (UK). He received his Ph.D. from Newcastle University (UK) in 2004. His research concerns understanding brain mechanisms of auditory perception, cognition and emotion processing in normal human subjects and how these mechanisms go wrong in disorders of perception such as musical hallucinations and disorders of emotion processing such as misophonia. To address these questions he uses functional magnetic resonance imaging (fMRI) and magnetencephalography (MEG) combined with computational modeling and behavioral testing. Dr. Kumar has published over 30 peer-reviewed articles in neuroscience journals and recently published “The brain basis for misophonia,” in Current Biology (2017) with co-authors S., Tansley-Hancock O., Sedley W., Winston J.S., Callaghan MF., Allen M., Cope TE., Gander PE., Bamiou D-E., and Griffiths TD. For Dr. Kumar’s full publication list, please see https://www.ncl.ac.uk/ion/staff/profile/sukhbinderkumar.html#publications. In our previous fMRI study (Kumar et al., 2017, Current Biology) we identified the brain areas which are hyperactive (compared to controls) in response to trigger sounds in participants with misophonia. However, fMRI being ‘slow’ in measuring the brain activity, it cannot measure the moment-by-moment changes (dynamics) in the brain activity. The aim of the present study is determine the dynamics of the brain activity, which can be measured at the scalp using electroencephalography (EEG) or magnetencephalography (MEG). One advantage of measuring this activity is instead of using expensive measuring device such as fMRI, a relatively cheaper set-up, such as EEG, can be used for measurement of brain response, which has the potential of being useful for therapeutic purposes.

Michael Mannino has a BS in astrophysics and a Masters in Philosophy. He was recently a full-time professor of philosophy and critical thinking at Miami Dade College in south Florida. Michael taught courses in critical thinking, ethics, introduction to philosophy, and logic. Three years ago, Michael was accepted into a PhD program at the center for complex systems and brain sciences at Florida Atlantic University, where he is currently completing a doctorate in neuroscience. His research involves computational aspects of cognitive neuroscience, specifically, the investigation of large-scale brain networks by analyzing simulated data from the virtual brain project using computational causality testing. For more about Mr. Mannino please see https://www.misophoniainternational.com/misophonia-brain-connectivity/
IMRN Advisory Board

Joseph LeDoux, Ph.D.

Joseph LeDoux is the Henry and Lucy Moses Professor of Science at NYU in the Center for Neural Science, and he directs the Emotional Brain Institute of NYU and the Nathan Kline Institute. He also a Professor of Psychiatry and Child and Adolescent Psychiatry at NYU Langone Medical School. His work is focused on the brain mechanisms of memory and emotion and he is the author of The Emotional Brain, Synaptic Self, and Anxious. LeDoux has received a number of awards, including the Karl Spencer Lashley Award from the American Philosophical Society, the Fyssen International Prize in Cognitive Science, Jean Louis Signoret Prize of the IPSEN Foundation, the Santiago Grisolia Prize, the American Psychological Association Distinguished Scientific Contributions Award, the American Psychological Association Donald O. Hebb Award. His book Anxious received the 2016 William James Book Award from the American Psychological Association. LeDoux is a Fellow of the American Academy of Arts and Sciences, the New York Academy of Sciences, and the American Association for the Advancement of Science, and a member of the National Academy of Sciences. He is also the lead singer and songwriter in the rock band, The Amygdaloids. For a comprehensive list of Dr. LeDoux's journal publications and books please see the LeDoux lab http://www.cns.nyu.edu/home/ledoux/.

Tammy Riegner, Au.D.

Dr. Tammy Riegner has worked as an audiologist for 20 years for both the adult and pediatric populations. Before receiving her Master of Science in Audiology from West Virginia University in 1997, she helped establish the WVU Hearing Conservation Program. She has worked in both hospital and private practice ENT settings, providing audiological and vestibular evaluations as well as amplification services to patients. In 2015, she pursued her Doctorate in Audiology from A.T. Stills University while working for Nemours/A.I. DuPont Hospital for Children where she has worked serving the pediatric population since 2008. Her main areas of specialty are pediatric diagnostics, electrophysiological assessment of the peripheral and central auditory pathways, and Central Auditory Processing evaluation. She has collaborated with Nemours Research Department at the Center for Pediatric Auditory and Speech Sciences (CPASS) to translate research into clinical protocols for assessment.
Edward D. Levin, Ph.D.

Edward Levin is a Professor of Psychiatry and Behavioral Sciences at Duke University Medical Center. He has secondary appointments in the Department of Pharmacology and Cancer Biology, the Department of Psychology and Neuroscience and the Nicholas School of the Environment at Duke University. He directs the Neural and Behavioral Assessment and Training Cores of the Duke University Superfund Basic Research Program and is former Director of the Duke Integrated Toxicology Program. Dr. Levin earned his Ph.D. in Environmental Toxicology in 1984 at the University of Wisconsin. He was an NIH-sponsored Post-doctoral fellow in Psychopharmacology at the Psychology Department at University of California at Los Angeles and was a visiting scientist at Uppsala University in Sweden. Since 1989 he has conducted research and taught at Duke University. Dr. Levin’s research interests concern neurobehavioral pharmacology and toxicology. He investigates the neurobehavioral bases of sensorimotor response, addiction and cognitive function with a focus on the roles nicotinic receptor systems in sensory processing, drug abuse, cognitive function and developmental neurobehavioral toxicology in rats, mice and zebra fish. He has published over 370 articles and chapters, edited four books and has been granted nine patents from over 35 years of research. He is particularly concerned with addiction and toxicant and therapeutic drug effects on neurobehavioral function including learning, memory, attention, emotional function and sensorimotor modulation. His research is directed not only at determining the functional nature and persistence of impairment, but also the mechanisms of dysfunction and the therapeutic treatments to counteract the damage. He has served as president of Neurobehavioral Teratology Society as well as the Behavioral Toxicology Society. He is co-director of the Duke Center on Addiction and Behavior Change and president of the International Neurotoxicology Society. For a list of Dr. Levin’s publications please see the Levin Lab [https://scholars.duke.edu/person/edlevin](https://scholars.duke.edu/person/edlevin)
IMRN Advisory Board

Amanda Michel, OTR/L

Amanda is a senior therapist at Sensational Achievements and the Feeding Program Coordinator, responsible for evaluation and oversight of programming for children receiving feeding therapy, both for picky eating and treatment of more complex motor or medical issues. She received her Bachelors of Science in Occupational Therapy from the University of Southern California in 1995, and her Masters of Leadership Studies from North Central College in 2004. Amanda is an advanced practice pediatric occupational therapist with 20+ years of pediatric experience ranging from direct treatment to administration. She has experience with inpatient neonatal and pediatric intensive care, outpatient clinic settings and specialty clinics, working with children in their school environment, and educating future occupational therapists as an adjunct professor and mentor. She is neonatal oral motor assessment certified, was an international board certified lactation consultant from 2006-2011, and teaches infant massage. Amanda has continuing education in a variety of pediatric therapy techniques including sensory integration, NDT, feeding (NICU graduates, challenging breast/bottle feeding, cleft palate, tube to oral feedings, sequential oral sensory approach, food chaining), fussy baby, yoga, and pediatric fine motor/hand therapy/splinting. Research based interventions, collaboration with parents and professionals, and creative yet flexible treatment strategies imbedded in fun filled engaging play are the foundation of her practice. For more about Ms. Michel please see https://sensational-achievements.com/

Arjan Schröder, Ph.D.

Arjan Schroder is a Dutch psychiatrist who started his Ph.D. research project on Misophonia in 2011 at the department of psychiatry of the Academic Medical Center (AMC) in Amsterdam, The Netherlands. This misophonia project, which includes various studies, e.g. neuro-imaging, EEG, genetics and the development of effective treatment, was created at the AMC. Currently Dr. Schroder is a psychiatrist at GGZ in Geest, a mental health institute in Amsterdam. For Dr. Schroder’s publications https://www.researchgate.net/profile/Arjanschroeder
Jenna Pellicori received her Bachelor’s Degree from James Madison University, and her Doctoral degree from Salus University (with a concentration in Biomedical Sciences). Dr. Pellicori graduated as valedictorian and currently serves as the lead audiologist at Nemours/Alfred I DuPont Hospital for Children’s New Jersey satellite locations. Dr. Pellicori is licensed to practice audiology in New Jersey, Pennsylvania, and Delaware, and she holds a hearing aid dispensing license for the state of New Jersey. She maintains her Certificate of Clinical Competence from the American Speech-Language-Hearing Association. Dr. Pellicori’s main interests include pediatric diagnostics and intervention, central auditory processing disorders, newborn hearing screens, amplification, and auditory brainstem response evaluations. Dr. Pellicori believes a multi-disciplinary approach is essential to improving the quality of care for her patients, and she welcomes teamwork and collaboration. For more about Dr. Pellicori, please see https://www.linkedin.com/in/jenna-pellicori-curry-a2185278

Lucy Jane Miller, Ph.D., OTR

As the founder of the first comprehensive Sensory Processing Disorder research program nationwide, and author of groundbreaking Sensational Kids: Hope and Help for Children with Sensory Processing Disorder and No Longer A SECRET: Unique Common Sense Strategies for Children with Sensory or Motor Challenges, Dr. Lucy Jane Miller’s name is synonymous with sensory research, education, and treatment. Dr. Miller has been investigating, analyzing, and explaining Sensory Processing Disorder to other scientists, professionals, and parents since she studied under sensory integration pioneer A. Jean Ayres, Ph.D., more than thirty years ago. Since then, studies by Dr. Miller and her colleagues have helped bring SPD widespread recognition, and her work with families has improved countless lives. Thanks specifically to Dr. Miller’s mobilization of the research community, SPD now appears in two diagnostic manuals: the ICDL’s Diagnostic Manual for Infancy and Early Childhood and The Diagnostic Classification: Zero to Three. Her application has led to consideration of SPD for inclusion in the 2013 revision of the Diagnostic and Statistical Manual (DSM-V). Dr. Miller has also developed seven nationally standardized tests for use worldwide to assess and diagnose SPD and other developmental disorders and delays. Dr. Miller’s widespread recognition and enormous credibility within the professional community are part of the reason that advanced clinicians travel from all over the United States and other countries to be mentored by Dr. Miller and her team at the SPD Foundation (formerly KID Foundation) that she founded three decades ago. For Dr. Miller’s publications please see https://www.spdstar.org/basic/our-research-team
Stephen W. Porges, Ph.D.

Dr. Porges is currently a Distinguished University Scientist at Indiana University Bloomington and is formerly a professor in the Department of Psychiatry at the University of North Carolina in Chapel Hill, North Carolina. Prior to moving to North Carolina, Dr. Porges directed the Brain-Body Center in the Department of Psychiatry at the University of Illinois at Chicago, where he also held appointments in the Departments of Psychology, Bioengineering, and the Program in Neuroscience. Prior to joining the faculty at the University of Illinois at Chicago, Dr. Porges served as Chair of the Department of Human Development and Director of the Institute for Child Study. He is a former President of the Society for Psychophysiological Research and has been president of the Federation of Behavioral, Psychological and Cognitive Sciences (now called the Federation of Associations in Behavioral & Brain Sciences), a consortium of societies representing approximately 20,000 bio-behavioral scientists. In 1994 he proposed the Polyvagal Theory, a theory that links the evolution of the autonomic nervous system to the emergence of social behavior. The theory provides insights into the mechanisms mediating symptoms observed in several behavioral, psychiatric, and physical disorders. The theory has stimulated research and treatments that emphasize the importance of physiological state and behavioral regulation in the expression of several psychiatric disorders including Autism, and provides a theoretical perspective to study and to treat stress and trauma. Stephen Porges is married to C. Sue Carter, a world leader in the role of neuropeptides oxytocin and vasopressin in social cognition. They have two sons, Eric and Seth Porges. For Dr. Porges’ publication list please see http://stephenporges.com/

M. Zachary Rosenthal, Ph.D.

Dr. Rosenthal is the Vice Chair for Clinical Services at the Duke University Medical Center Department of Psychiatry. He is also an Associate Professor with a joint appointment in the Department of Psychiatry & Behavioral Sciences in the Duke University Department of Psychology and Neuroscience. He is director of the Misophonia and Emotion Regulation (formerly the Sensory Processing and Emotion Regulation Program founded by Dr. Jennifer Jo Brout and the Duke Cognitive Behavioral Research and Treatment Program (CBRTP). Dr. Rosenthal’s research has focused on emotion regulation in adult psychopathology, the development of novel, computer-based interventions for treatment-resistant populations, and the generalization of emotion regulation from the clinic into the natural environment using conditioned reminders of learning. He has published in scientific journals and books, including Emotion, Journal of Abnormal Psychology, Clinical Psychology Review, Journal of Traumatic Stress, and Behavior Research and Therapy. For Dr. Rosenthal’s papers please see https://psychandneuro.duke.edu/people/mark-zachary-rosenthal
Aubrey Schmalle, OTR/L, SIPT

Aubrey Schmalle is a registered occupational therapist licensed in Connecticut and New York. She specializes in using a sensory-based approach to help children develop the skills they need to live, learn, and play. After graduating with a bachelor’s degree from Boston University in 2002, she completed a specialty fieldwork at a clinic that is a leader in the field of sensory integration research. She continued her studies to obtain an advanced certification in sensory integration theory and practice. Her areas of expertise include functional visual skill development, visual-vestibular integration, praxis and executive function, and using sound-based therapies to enhance treatment outcomes. Since 2005, she has developed four in-clinic fieldwork programs and supervised several masters-level occupational therapy students. She also educates parents, teachers, and other professionals on the value of using sensory-based treatment techniques to facilitate learning and speech development. She has worked with children with a variety of diagnoses including autism spectrum and sensory processing disorders, as well as neuromotor impairments, genetic disabilities, and vision impairments. For more about Aubrey please see https://sensational-achievements.com/

Teresa Tavassoli, PhD.

Dr. Tavassoli is currently a Lecturer at the University of Reading. She holds a Ph.D in Psychology from the University of Cambridge, United Kingdom. She did her postdoctoral fellowship at the Icahn School of Medicine/Mount Sinai Hospital, at the Seaver Autism Center (where she was also hired as an Instructor). Her research is dedicated to deepening our understanding of sensory reactivity in autism spectrum disorder (ASD) and its variation across the entire population. My goal is first to identify the most robust and objective ways to measure sensory reactivity, a new DSM-5 criterion, in children and adults with ASD, which can be used to guide diagnosis, guide sensory-based treatments and test treatment effects. My second goal is to elucidate underlying neural and genetic mechanisms of abnormal sensory reactivity in children with and without ASD. Last, my goal is to identify links between sensory reactivity and mental health issues in autism more generally.

https://www.reading.ac.uk/Psychology/About/staff/t-tavassoli.aspx
Other IMRN & MI Projects & Collaborators

Psychology Today Blog: Dr. Jennifer Brout
Noises Off
https://www.psychologytoday.com/us/blog/noises

Joe LeDoux Documentary Film (and Concept Videos)
https://www.youtube.com/channel/UCIGdcothHU6RxDjeODk5hkQ/videos

Allergic to Sound
www.allergicitosound.com
https://self-reg.ca/

Different Brains®
http://differentbrains.org/

A2A Alliance
LEADING THE WAY FROM ADVERSITY TO ADVOCACY
http://a2aalliance.org/