2024 NeuGeneration Case Competition: Neurodiversity

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URNCST Journal
"Research in Earnest"

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Note: Correction added after original version published on March 12, 2024. We regret any inconvenience caused.

Abstract:
The NeuGeneration Case Competition is an annual research case competition organized by students in the NeuGeneration Club at Queen's University. Held during our 9th annual neuroscience conference on February 3rd and 4th, 2024, at the Queen's School of Medicine Building, the competition aims to provide undergraduate students with valuable research experience and networking opportunities in the field of neuroscience. Students in teams of 1-5 were given a month to prepare an abstract and an oral presentation on a novel research question within the theme of Neurodiversity. This booklet showcases the abstracts of the top five teams. We hope you enjoy exploring the proposals and we encourage you to be on the lookout for next year's case competition through our Instagram (@q_neugeneration).

Keywords: NeuGeneration Case Competition; Neuroscience; Neurodiversity; Mental Health; ADHD; Autism Spectrum Disorder; Antisocial Personality Disorder; PTSD; Case Competition; NeuGeneration

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Conference Abstracts
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NeuGeneration Abstracts

Sound Map Intervention for Minimization of Sound Hypersensitivity Distress Experienced Amongst Neurodivergent Populations
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Hypersensitivity to loud noises is commonly experienced among individuals with neurodivergent conditions, including post-traumatic stress disorder, autism, and attention-deficit hyperactivity disorder. Consequently, individuals report

anxiety, physical pain, recurring trauma, and other forms of distress. Over 40% of noise-sensitive children with autism flee from distress-causing sounds, causing injuries. Current interventions, such as earmuffs, prioritize the neuronormative diaspora over the needs of neurodivergent communities. The proposed intervention uses geographic information systems technology to create a volume map displaying decibel levels and possible sound triggers like beeps and sirens in the area, so users can plan routes accordingly. Real-time, user-submitted information regarding events like road accidents, festivals, and construction sites will be utilized. To evaluate the intervention's efficacy, a sample of 50 non-neurodivergent participants will be randomly assigned into an experimental or control group. Both groups will navigate to the same destination, with the experimental group utilizing the sound map and control group utilizing current interventions. Each participant will be equipped with a decibel meter to collect sound levels throughout their journey and a recorder to track the frequency of encounters with specific triggers. Independent t-tests and chi square tests will be conducted to analyze the significance of differences between groups regarding average sound levels and frequency of encounters with trigger types. P-values less than $\alpha=0.05$ will indicate the sound map to be effective. This intervention presents a novel solution which focuses on minimizing distress experienced by neurodivergent communities—allowing all to take part equally in embracing neurodiversity.

Leptin as a Therapy to Treat Aggression in Antisocial Personality Disorder

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Antisocial personality disorder (ASPD) is characterized by impulse aggression often leading to violence, criminal behaviour, and suicide. Previous studies have linked the endocannabinoid system in the brain to ASPD's pathophysiology and aggressive presentation. Specifically, lower fatty acid amide hydrolase (FAAH) activity due to a C385A polymorphism has been implicated in increased activation of CB1 receptors leading to aggressive behaviour. FAAH metabolises anandamide (AEA) which activates CB1 receptors, thus, lower FAAH increases AEA levels and CB1 activation. Studies related to weight found that leptin administration has increased FAAH
activity in mice with the C385A polymorphism. Our study seeks to identify a potential therapy for ASPD symptoms by restoring FAAH activity to physiological levels using leptin. We will house 16 C57BL/6 mice containing the C385A polymorphism according to OECD guidelines. Half will receive saline solution, the other half will receive 2 mg/kg body weight of recombinant murine leptin both through intraperitoneal injection once per day for 70 days. For two hours following administration, two mice from the same group will be placed together and instances of kicking, biting, and fighting will be recorded as aggressive behaviour. At the end of the study, an assay measuring the conversion of labelled AEA into labelled ethanolamine will quantify FAAH activity. We anticipate significantly lower instances of aggression and increased FAAH enzyme activity in the treatment group compared to controls. Following, more research with larger sample sizes on the potential for leptin as a therapy for ASPD and other disorders with impulse aggression is required.

Exploring the Therapeutic Potential of Psilocybin in PTSD Rehabilitation

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Post-Traumatic Stress Disorder (PTSD) is a neurodivergent condition acquired following a maladaptive response to a stressful event, resulting in executive function difficulties. 1 Approximately 8% of Canadian adults and 12.5% of veterans suffer from PTSD, making them 13 times more likely to commit suicide. Effective PTSD treatment, encompassing trauma-focused psychotherapy (TFPt) and daily serotonin reuptake inhibitors (SSRI), is limited to less than half the population, highlighting the necessity for alternative approaches. Psychedelic treatment with psilocybin has been shown to treat anxiety and depression, but has yet to be explored for PTSD. This double-blinded, randomized, controlled trial aims to compare the effectiveness of psilocybin versus sertraline, an SSRI, in treating veterans diagnosed with PTSD. 60 Canadian veterans will be divided into two demographic-matched groups. The psilocybin group will receive two doses of 25mg psilocybin, one week apart, and daily placebo. The sertraline group will receive two doses of placebo, one week apart, and daily sertraline. All patients will receive interdisciplinary TFPt care (i.e., somatic, neurofeedback, psychotherapy sessions) in a 10-day in-patient retreat. Symptom severity and well-being will be measured using the PTSD checklist for DSM-5 (PCL-5) scale across six timepoints: pre-, mid-, immediately post-retreat, as well as 1-, 3-, and 6-months post-retreat. A repeated measures

ANOVA will identify differences in PCL-5 scores across groups and time points. We hypothesize that both groups will have over 20% reductions in PCL-5 scores, 6 months post-retreat, suggesting significant symptom improvements. Overall, this study will provide substantial implications for alternative PTSD treatment options.

Investigating the Efficacy of a 10-Week Educational Program for Students With ADHD: Randomized Control Trial

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Students with attention-deficit hyperactivity disorder (ADHD) typically exhibit poor school performance due to a range of academic deficits. Despite the standard provision of time accommodations in educational settings for students with ADHD, a significant gap in empirical evidence for these interventions exists, highlighting the need for innovative, evidence-based solutions. This study evaluates the efficacy of "Focus Forward," a 10-week program designed to address academic challenges faced by students with ADHD. A randomized control trial will be conducted with 200 clinically diagnosed high-school ADHD participants aged 13–17. Participants will be randomized to the intervention group, receiving the "Focus Forward" program, or the control group, receiving standard educational support. The intervention program integrates personalized learning plans, cognitive-behavioural strategies, and executive function training, supplemented by parental and educator involvement. Data will be collected pre- and post-intervention using standardized academic tests. Qualitative feedback from participants, parents, and teachers will be analyzed using thematic coding to identify prevailing themes. Two- sided t-tests will be utilized to compare academic performance between and within groups after intervention. It is anticipated that students undergoing the "Focus Forward" program will significantly improve their academic scores post-intervention, exhibiting greater improvement than the control group. This hypothesis stems from previous research indicating that personalized educational strategies with substantial teacher engagement are the most significant contributors to enhancing academic performance. These study's findings have the potential to transform educational practices for students with ADHD, guiding educators, policymakers, and healthcare professionals toward more inclusive and empirically supported educational interventions.

The Impact of Masking on Intrapersonal Perceptions of Friendships During Adolescence for Autistic Adolescents

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Masking refers to the act of suppressing traits associated with autism, and various other strategies to appear neurotypical. Current research suggests masking has a negative impact on receiving a diagnosis alongside overall psychological well-being. As adolescent peer relationships play a significant role in social development, this study aims to explore the effects of masking and its impact on the intrapersonal perceptions of social relationships of autistic adolescents. This study will analyze data collected from a cross-national survey for autistic adolescents. The questions will target three overarching themes: masking behaviors and strategies, intrapersonal perception and relationship dynamics, and psychological well-being, using a mixed methods design. For six months, 200-300 autistic individuals between 13-19 years old would complete an anonymous one-hour online survey, consisting of open-ended and closed- ended questions, and results will be analyzed using both thematic and statistical analysis. The key focus of the study is to investigate whether increased levels of masking are associated with lower emotional fulfillment in adolescent friendships. One prominent result that might come out could be that those who did not mask with friends reported reduced burnout, highlighting how peer relationships can offer a supportive environment for autistic individuals to engage in coping strategies. It is anticipated that higher levels of masking among autistic adolescents will correlate with a generally negative self-perception of friendships. Conversely, individuals who might hesitate to "unmask" with friends may feel disconnected, reducing their interest in future social relationships due to emotional unfulfillment.

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