

15th ANNUAL

CSURF

2018

SATURDAY

APRIL 28, 2018

9 A.M. – 4:15 P.M.

COLORADO SPRINGS UNDERGRADUATE RESEARCH FORUM

HOSTED AT COLORADO COLLEGE







ARMSTRONG HALL

100

100

Informational sign with text and graphics.



From Left: Alec Sheffield, Camille Ginsburg, Kelly Culshaw, Sarah Barker, Caleigh Cassidy, Katharine Teigen, Allysa Warling, Robert Welch, Paige Anton

Poster 15

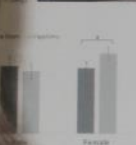
Supplementation with *Bifidobacterium infantis* Reduces Social Anxiety but Does Not Affect Compulsive Behavior in Adolescent Rats

K. A. Teigen & L. L. Driscoll
Colorado College, Colorado Springs, CO



Social Interaction Test

Measures:
 - # of interactions (total per hour)
 - % of critical hits (successful removal of aversive)



Vegetarian rats interacted more than Sham rats. Veg+ rats interacted more than Sham rats. *p < 0.05

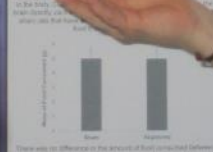
Marble Burying Task

Measures:
 - Latency to bury (s)



There were no significant differences between groups.

Cherry Picking Test



There was no difference in the amount of food consumed between groups.

Discussion

Social Anxiety
 - Adolescent rats given probiotic *B. infantis* showed reduced anxiety in both sexes, but significantly in males.
 - *B. infantis* may be a novel treatment for anxiety.
 - Probiotics may be used to reduce anxiety in humans.
 - The results of this study may provide additional evidence for the use of probiotics to reduce anxiety.

Compulsive Behavior
 - There was no effect of *B. infantis* on anxiety or on the number of marbles buried. This suggests that *B. infantis* may affect the emotional but not the cognitive aspects of anxiety.
 - It is possible that the inability to bury the marbles is not an accurate measure of compulsive behavior.

Vegetary Consumption
 - Vegetarian rats showed no difference in anxiety or in the number of marbles buried. This suggests that a vegetarian diet may not affect anxiety in adolescent rats. This suggests that the effect of *B. infantis* on anxiety may be independent of the diet.
 - We plan to continue to study the relationship between probiotics and anxiety in adolescent rats.

Future Directions

1. Evaluate the effects of *B. infantis* on anxiety in adolescent rats with different anxiety phenotypes.
2. Compare the effects of *B. infantis* on anxiety in adolescent rats with different anxiety phenotypes and different diets.
3. Test the effects of *B. infantis* on anxiety in adolescent rats with different anxiety phenotypes and different diets.

Poster 38

Enterococcus faecalis 35624 Supplementation in Eubiotic Adolescent Rats Does Not Influence Anxious or Compulsive Behaviors

Paige E. Anton & Lori L. Driscoll
Laboratory of Behavioral Neurotoxicology
The Colorado College, Colorado Springs, CO

Subjects

Male and female Long Evans rats (21-24, 40 females) were used. They were housed in pairs in a temperature-controlled environment (22-24°C) with a 12-hour light/dark cycle. All rats were handled by the same experimenter to minimize stress.



Method

Subjects were divided into two groups: Eubiotic (EUB) and Eubiotic + *E. faecalis* 35624 (EUB+). The EUB+ group received a daily oral gavage of *E. faecalis* 35624 (10⁸ CFU) in 0.1 ml of sterile saline solution. The EUB group received only the saline solution.

Behavioral Testing

Behavioral testing was conducted 28 days after the start of supplementation. The tests used were the Elevated Plus Maze (EPM) and the Compulsive Behavior: Marble Burying Task (CBT).

Anxious Behavior: Elevated Plus Maze

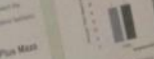


EPM Test 1: Anxious Behavior of E. faecalis

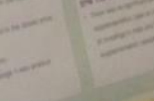


There was no significant difference in the number of entries into the open arms between the EUB and EUB+ groups ($p > 0.05$).

Compulsive Behavior: Marble Burying Task



CBT Test 2: Compulsive Behavior of E. faecalis



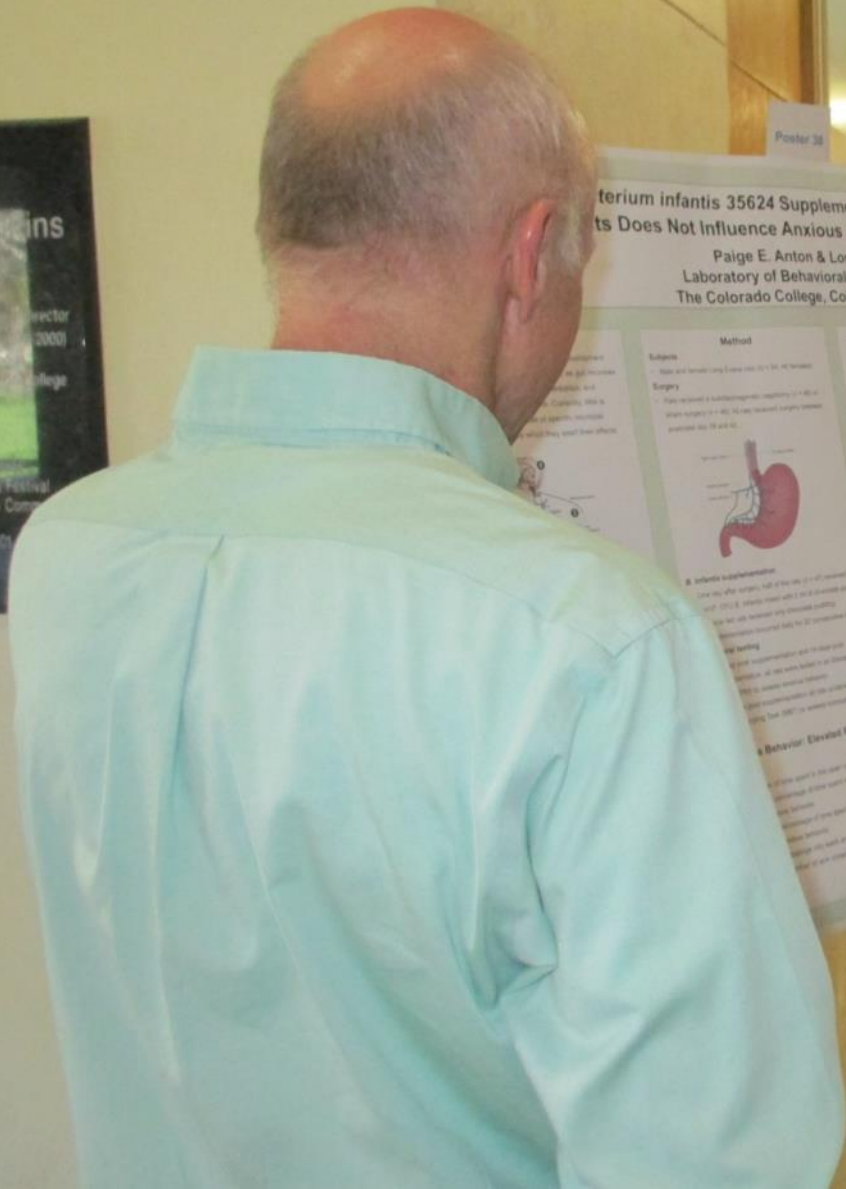
There was no significant difference in the number of marbles buried between the EUB and EUB+ groups ($p > 0.05$).

Discussion

The present study was designed to test the hypothesis that supplementation with *E. faecalis* 35624 would influence anxious or compulsive behaviors in eubiotic adolescent rats. The results of the present study indicate that supplementation with *E. faecalis* 35624 does not influence anxious or compulsive behaviors in eubiotic adolescent rats. This finding is consistent with the idea that the gut microbiome plays a role in the development of anxiety and compulsive behaviors, but that the presence of *E. faecalis* 35624 is not sufficient to alter these behaviors in eubiotic rats.

Conclusions

The present study indicates that supplementation with *E. faecalis* 35624 does not influence anxious or compulsive behaviors in eubiotic adolescent rats.



Poster 36

Long-term dendritic and spine changes following repetitive traumatic brain injury



Allysa P. Warling¹, Madeleine E. Garcia¹, Noah Beckett Shea-Shumsky¹, and Bob Jacobs¹
¹Laboratory of Quantitative Neuromorphology
Neuroscience Program, The Colorado College, Colorado Springs, CO, 80903

Abstract
Brain injury (RTBI) is a risk factor for long-term cognitive decline. We examined potential long-term effects of frontal and occipital cortex following RTBI. In cases with and without RTBI, tissue was stained with a silver-stain (Jacobs et al., 1987). Tissue was stained for CTE, diagnosed, and analyzed using confocal microscopy and image analysis. Most spine density and length were decreased in both frontal and occipital cortex in comparison to control tissue. The spine density was TE diagnosed. The spine length was TE diagnosed. Such effects may have implications for cognitive functions, with or without cognitive diagnosis.

Introduction
Repetitive brain injury (RTBI) may have long-term effects, including affecting the brain's ability to process information and regulate behavior (Katz et al., 2013). Changes in cortical spine density and length have been reported (Katz et al., 2013). However, previous studies (Cassidy et al., 2014) have not examined the effects of TB and CTE on spine density and length in the frontal and occipital cortex. The present study focused on the long-term effects of RTBI on spine density and length in the frontal and occipital cortex of the human neocortex.

Subjects
Tissue from six male subjects ($M_{age} = 31 \pm 11$ years) with a history of RTBI was obtained from the Boston University CTE Center (Boston, MA). This constituted the CTE group. Tissue from six age-matched controls ($M_{age} = 31 \pm 11$ years) was obtained from the Boston University CTE Center. This constituted the control group. All subjects were TE diagnosed.

Tissue Preparation
Coronal blocks generally encompassing Brodmann's areas 46A, 9, and 17 in the frontal cortex were stained with a silver-stain (Jacobs et al., 1987). Tissue was stained for CTE, diagnosed, and analyzed using confocal microscopy and image analysis.

Neuron Selection and Quantification
Biocytin-labeled pyramidal neurons in the CTE group were traced under a 40x dry objective. Spine density and length were quantified for the control group. Neurons ($N = 400$) were quantified in a 40x dry objective. Spine density and length were quantified for the control group. Neurons ($N = 400$) were quantified in a 40x dry objective.

Dependent Measures
Neurons were quantified with five dependent measures: spine density, spine length, spine area, spine volume, and spine volume density. Spine density and length were quantified for the control group. Neurons ($N = 400$) were quantified in a 40x dry objective.

Results
Spine density and length were significantly lower in the CTE group compared to the control group. Spine area and volume were also significantly lower in the CTE group. Spine volume density was not significantly different between groups.

Discussion
The present study found that spine density and length were significantly lower in the CTE group compared to the control group. This suggests that RTBI may have long-term effects on spine density and length in the frontal and occipital cortex of the human neocortex.

Conclusions
The present study found that spine density and length were significantly lower in the CTE group compared to the control group. This suggests that RTBI may have long-term effects on spine density and length in the frontal and occipital cortex of the human neocortex.





So You Think You're a Creep

Tomi-Ann Roberts, Kelly Culshaw, CA
The Colorado College, CA



Study 1: Developing a Validated Caring System for Sexualized Dance

Introduction
Sexualized dance is a common form of entertainment in college environments, but it is often associated with negative outcomes such as sexual assault and unwanted sexual experiences. This study aimed to develop a validated caring system for sexualized dance that could be used by campus organizations to provide support and resources for students who may be affected by these experiences.

Method
A total of 100 college students participated in the study. They completed a survey that assessed their attitudes toward sexualized dance and their willingness to provide support to students who may be affected by these experiences. The survey also assessed their knowledge of campus resources and their willingness to seek help if they needed it.

Results
The results of the study showed that a majority of students (75%) had a positive attitude toward sexualized dance. However, 25% of students reported that they had experienced a negative outcome as a result of sexualized dance. Additionally, 40% of students reported that they were willing to provide support to students who may be affected by these experiences. The study also found that 60% of students were aware of campus resources and 30% of students were willing to seek help if they needed it.

Conclusion
The results of this study suggest that there is a need for a validated caring system for sexualized dance. This system could be used by campus organizations to provide support and resources for students who may be affected by these experiences. The study also found that a majority of students have a positive attitude toward sexualized dance, which suggests that there is a need for a caring system that can provide support and resources to students who may be affected by these experiences.

Overall, the study found that a majority of students have a positive attitude toward sexualized dance, but there is still a need for a validated caring system to provide support and resources for students who may be affected by these experiences.



The most common reason for providing support was that the student was a friend or acquaintance of the student who was affected by the experience.



The Difficulty Principle: Language's Effect on Perceptual Discrimination Depends on Difficulty

Robert E. Welch and Kevin J. Holmes
The Colorado College, Colorado Springs, CO

Introduction

Does the language you speak affect how you think? ...

Language Affects Color Perception ...

On Behavior ...

Experiment 1a - Outline

• Goal: ...

Experiment 1b - Outline

• Goal: ...



Figure 1. RT (ms) vs Perceptual Distance for Experiment 1a.

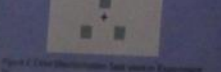


Figure 2. 2-alternative Task used in Experiment 1a.

Experiment 1a - Results

- RT difference scores (DRT) were computed by subtracting mean RT on between-category trials from mean RT on within-category trials.

- DRTs were regressed on perceptual distance units (2-6).

- According to the Difficulty Principle, a positive slope should be observed, indicating stronger CP at smaller distances (i.e., more difficult discriminations).

- The prediction was supported: the mean slope was positive ($M = 17$ ms/unit distance, $SD = 20$) and differed significantly from zero, $t(17) = 2.73, p < .01$.

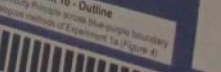


Figure 3. RT (ms) vs Perceptual Distance for Experiment 1b.



Figure 4. 4-alternative Task used in Experiment 1b.

Experiment 1b - Results

- Difficulty Principle supported in accuracy data but not in reaction time data.

- Possible explanation lies in Accuracy/speed tradeoff: participants made twice as many errors in Experiment 1b than in Experiment 1a (8.3% vs. 3.2%), consistent with the greater perceptual similarity of the blue/purple stimuli.

- Regressing DACC scores (accuracy on between-category trials minus accuracy on within-category trials) on perceptual distance units (2-6) produced a mean negative slope ($M = -2.2\%$ /unit distance, $SD = 2.1$) that differed significantly from zero, $t(17) = -4.50, p < .001$.



Figure 5. Mean Accuracy by Perceptual Distance for Experiment 1b.

Figure 6. Mean Accuracy by Perceptual Distance for Experiment 1a. The y-axis ranges from 0.70 to 1.00. The x-axis shows perceptual distances 2 through 6. Two series are shown: 'between-category' (black bars) and 'within-category' (grey bars). Both series show an upward trend, with between-category accuracy consistently higher than within-category accuracy.

Experiment 2 - Outline

• Motivation ...

• Materials ...

• Design ...

• Future research ...



Figure 7. Mean RT (ms) vs Perceptual Distance for Experiment 1b.

Experiment 2

- A repeated-measures design with visual field (within-between-categories) as factors.

- Supporting the Difficulty Principle, there was a significant interaction between perceptual distance and visual field, $F(2, 17) = 4.50, p < .01$.

- There was no interactive effect of category relationship (within-between-categories) on accuracy, $F(2, 17) = 0.00, p > .05$.

- Participants were faster on between-category trials than on within-category trials, consistent with the magnitude of the effect.


- These findings contrast previous studies that measured the effect of language on perception.

- Future research should investigate other domains beyond perception.

Selected References


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Vector Analysis
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Stigma in Bipolar Disorder: The Impact of Cause and Treatment Information

Cafeigh Cassidy and Kristi Erdal
The Colorado College, Colorado Springs, CO



Stigma

negative attitudes and beliefs held by the general public regarding people who exhibit illness (Corrigan et al., 2003)

includes cognitive, affective, and behavioral components

Stereotypes of incompetence, unpredictability, violence, responsibility for illness

Affective reactions of anger and discomfort plus behavioral reactions of desire for social distance

Attribution Theory

describes process of attributing cause to behavior (Heider, 1958; Weiner, 1985)

influenced by perceived controllability and stability of cause

- Controllable causes viewed with more anger
- Some view cause of mental illness as controllable
- stable causes viewed as unlikely to change over time

Essentialism

- Tendency to regard members of a category as sharing an essential (and hereditary) nature (Ogden & Haslam, 2011)
- Causes associated with groups thought to be biologically based have greater essentialism
- Many anti-stigma campaigns promote a biological view of mental illness, attributing it to genetics or chemical imbalances
- Anti-stigma campaigns that promote biological imbalances lessen amounts of stigma such as social distance

Study Objectives

To understand the stigma of bipolar disorder (BD) treatment and research has focused on depression or schizophrenia

To investigate what causes anger, indignation, or discomfort (and how these emotions relate to stigma) in response to information about BD

To examine whether treatment information can reduce stigma

Hypotheses

Information

- Biogenetic cause information will increase attribution of internal causes of BD, the controllability of BD, and overall negative attitudes
- Psychosocial cause information will decrease attribution of internal causes of BD, the controllability of BD, and overall negative attitudes

Anger

- Biogenetic cause information will increase anger
- Psychosocial cause information will decrease anger

Social Distance

- Biogenetic cause information will increase social distance
- Psychosocial cause information will decrease social distance

Participants

- 300 individuals from America's Most Excellent Universities
- 100 males, 175 females, 3 non-binary, 1 transgender reported
- All participants were 19 or older (M = 36.79, SD = 11.60)

Vignettes

- Described Jake, an individual meeting DSM-5 criteria for BD
- Assigned Jake's BD to biogenetic causes or psychosocial causes
- Included treatment information or no treatment information

Independent Variables: 2 x 2 (Cause x Treatment)

Causal Information

- Biogenetic Cause** - described BD as a "highly heritable disease of the brain" that runs in families
- Psychosocial Cause** - described BD as a "learned illness that can be addressed by stress management"

Treatment Information

- Treatment Information** - stated that "there are effective treatments for bipolar disorder that have been well-researched" including Lithium and Cognitive Behavioral Therapy
- No Treatment Information**

Dependent Variables

- Social Distance Scale** (α = .91)
 - "How would you feel having someone like Jake as a neighbor?"
- Prognostic Pessimism Subscale** (α = .84)
 - "It is hard for someone with bipolar disorder to be completely cured"
- Responsibility Subscale** (α = .80)
 - "Bipolar disorder results from a failure of self-control"
- Attribution Questionnaire**
 - Fixed/Geneticness Subscale (α = .80)
 - Flux Subscale (α = .77)
 - Anger Subscale (α = .80)
 - Helping Subscale (α = .80)
- Unpredictability** (α = .80)
 - "People with bipolar disorder are completely unpredictable"
- Comfort with Normal Experiences Subscale** (α = .84)
 - "Some people experience reactions that we would show signs of bipolar disorder"
- Fear Level of Contact**
 - "I feel safe in a person who has a mental illness"


Procedure

- Participants read a randomly assigned vignette and answered attribution questions about the vignette's cause and treatment information
- Participants then did the measurements of stigma mentioned above
- Only from 21 participants were excluded from analyses because they failed both comprehension questions

Results

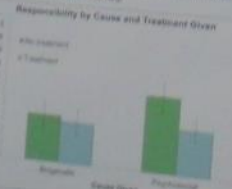
Causal Information

- Participants given biogenetic cause rated vignette character as significantly less responsible for his illness
 - $F(1, 211) = 2.80, p = .100, \eta^2 = .017$
- Biogenetic cause reduced beliefs in the controllability of BD with normal experience, $t(221) = 2.54, p = .012, \eta^2 = .010$
- No significant impact of cause on help, desire to help, fear, unpredictability, or prognosis pessimism



Treatment Information

- Treatment information significantly reduced
 - Responsibility $F(1, 221) = 4.88, p = .031, \eta^2 = .021$
 - Social Distance $F(1, 221) = 4.85, p = .032, \eta^2 = .021$
 - Fear/Unpredictability $F(1, 221) = 9.97, p = .002, \eta^2 = .041$
- No significant impact of treatment on prognosis pessimism, unpredictability, or desire to help




Predicting Social Distance

Multiple regression analysis revealed that can be predicted $F(1, 211, 201) = 58.813, p < .001, \eta^2 = .219$

- Helping $\beta = .000^*$
- Level of Contact $\beta = .211^*$
- Anger $\beta = .230^*$
- Unpredictability $\beta = .130^*$

Mediation

Anger partially mediated the relationship between treatment information and social distance, $\beta = 2.03, p = .042$



Four fully mediated the relationship between treatment information and social distance, $\beta = -2.80, p = .005$

Table 3: $n = 33, *p < .001$. Values in the mediation model are unstandardized regression coefficients used in the model.

Discussion

- Hypotheses 1 and 2 were partially supported
- Biogenetic cause reduced responsibility predictions, but also reduced attribution of internal causes
- Hypothesis 3 was partially supported
- Treatment information reduced responsibility, and fear/unpredictability
- Hypothesis 4 was supported
- Anger partially mediated the relationship between treatment information and social distance
- Fear fully mediated the relationship between treatment information and social distance
- Hypothesis 5 was fully supported
- Social distance was significantly predicted by unpredictability

Conclusions/Implications

- Results suggest that treatment information can reduce stigma
- Results suggest that treatment information can reduce stigma

Limitations/Future Research

- Research was correlational
- Research was correlational
- Vignettes were not representative of all people with bipolar disorder

Cafeigh Cassidy
 MS Student Researcher
 2019-2020

Handwritten notes on a clipboard, including the word "Anger" and some illegible scribbles.

Purification of a Kinase associated with the Ter Y-P Triad of *A. Baylyi* ADPI

Maxwell Higo, Lauren Wilmut, and Margaret Daugherty

Colorado College Department of Chemistry and Biochemistry, Colorado Springs, CO 80903



Abstract

The *A. baylyi* model gene cluster encodes a wide array of enzymes involved with cellulose and other polysaccharide. We are interested in characterizing a cellulose debranching enzyme of the Ter Y-P Triad (see Fig. 1) (Higo et al., 2017). This gene encodes a putative regulatory kinase or protein phosphatase with a conserved catalytic domain. The catalytic domain is highly similar to that of the *A. baylyi* Ter Y-P Triad. The catalytic domain is highly similar to that of the *A. baylyi* Ter Y-P Triad. The catalytic domain is highly similar to that of the *A. baylyi* Ter Y-P Triad.

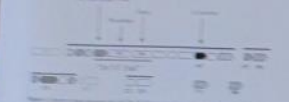


Figure 1: Schematic diagram of the protein structure showing domains and motifs.

Introduction

The *A. baylyi* model gene cluster encodes a wide array of enzymes involved with cellulose and other polysaccharide. We are interested in characterizing a cellulose debranching enzyme of the Ter Y-P Triad (see Fig. 1) (Higo et al., 2017). This gene encodes a putative regulatory kinase or protein phosphatase with a conserved catalytic domain. The catalytic domain is highly similar to that of the *A. baylyi* Ter Y-P Triad. The catalytic domain is highly similar to that of the *A. baylyi* Ter Y-P Triad.



Figure 2: Diagram of laboratory glassware including a flask, beaker, and pipette.

Figure



Figure 3: Two SDS-PAGE gels showing protein bands.

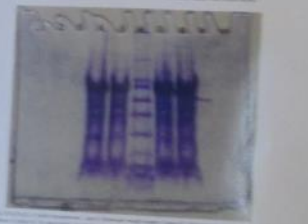


Figure 4: A large SDS-PAGE gel with multiple lanes and bands.



Figure 5: A large SDS-PAGE gel with a red box highlighting a specific band.

Methods

Protein expression was carried out in *E. coli* using the pET28a vector. The gene encoding the catalytic domain of the Ter Y-P Triad was cloned into the pET28a vector. The resulting recombinant plasmid was transformed into *E. coli* cells. The cells were grown in LB medium containing 0.5% glucose and 0.1% IPTG. The cells were harvested and lysed. The lysate was centrifuged and the supernatant was dialyzed into a storage buffer. The protein was purified using ion exchange chromatography.

Protein purification

The protein was purified using ion exchange chromatography. The protein was loaded onto a DEAE Sepharose column. The column was equilibrated with a low salt buffer. The protein was eluted with a linear gradient of NaCl. The protein was dialyzed into a storage buffer.

To confirm identity, the following modifications were made to the protein: N-terminal amino acid sequencing, mass spectrometry, and SDS-PAGE analysis. The resulting data were compared to the theoretical data for the protein.

Results and Discussion

The protein was purified to homogeneity. The protein was characterized by SDS-PAGE, mass spectrometry, and N-terminal amino acid sequencing. The protein was found to be highly similar to that of the *A. baylyi* Ter Y-P Triad. The protein was found to be highly similar to that of the *A. baylyi* Ter Y-P Triad.

Conclusion

The protein was purified to homogeneity. The protein was characterized by SDS-PAGE, mass spectrometry, and N-terminal amino acid sequencing. The protein was found to be highly similar to that of the *A. baylyi* Ter Y-P Triad. The protein was found to be highly similar to that of the *A. baylyi* Ter Y-P Triad.

References

- Higo, M., Wilmut, L., and Daugherty, M. (2017). Purification of a Kinase associated with the Ter Y-P Triad of *A. Baylyi* ADPI. *Colorado College Department of Chemistry and Biochemistry*.



Poster 28

5624 Supplementation in Eubiotic Adolescent
 Influence Anxious or Compulsive Behaviors
 Paige E. Anton & Lori L. Driscoll
 Laboratory of Behavioral Neurotoxicology
 Colorado College, Colorado Springs, CO

Method

Used a longitudinal design in 18 adolescent females (14-18 years old) who were screened for anxiety and compulsive behaviors.

Anxious Behavior - Revised PDI-R



Compulsive Behavior - Revised PDI-R

Results

Anxious Behavior - Revised PDI-R

Compulsive Behavior - Revised PDI-R

Conclusions

Supplementation with probiotics significantly reduced anxious and compulsive behaviors in adolescent females.



INFLUENCE OF THE BIFIDOBACTERIUM LACTIS ON ANXIETY AND COMPULSIVE BEHAVIORS

INFLUENCE OF THE BIFIDOBACTERIUM LACTIS ON ANXIETY AND COMPULSIVE BEHAVIORS




PLEASE
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Poster 15

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Probiotic Supplementation with *Bifidobacterium infantis* Alleviates Social Anxiety but Does Not Affect Compulsive Behavior in Adolescent Rats

K. A. Teigen & L. L. Driscoll
The Colorado College, Colorado Springs, CO



Introduction

Terminology

- *Bifidobacterium infantis* (Bifido) is a probiotic that has been shown to have beneficial effects on the digestive tract of humans and other animals.
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- *Bifidobacterium infantis* (Bifido) is a probiotic that has been shown to have beneficial effects on the digestive tract of humans and other animals.

Background

• Higher levels of social anxiety are associated with lower levels of social interaction and higher levels of social avoidance.

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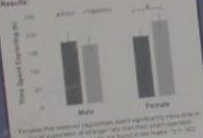
• Higher levels of social anxiety are associated with lower levels of social interaction and higher levels of social avoidance.

Social Interaction Test

Measures:

- Time spent in the open field
- Time spent in the center
- Time spent in the corners
- Time spent in the perimeter
- Time spent in the center
- Time spent in the corners
- Time spent in the perimeter

Results:




There were no significant effects of any treatment on the amount of time spent in the open field or in the center.

Marble Burying Task


Measures:

- Amount of time spent burying the marbles
- Amount of time spent sniffing the marbles
- Amount of time spent digging around the marbles

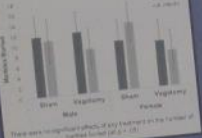
Initial Apparatus Set-Up



Example of a Finished Task



Results:



There were no significant effects of any treatment on the amount of time spent burying the marbles.

Discussion

Social Anxiety

- The results of the present study indicate that adolescent rats with social anxiety (SA) exhibit significantly higher levels of social anxiety than control rats.
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Compulsive Behavior

- The results of the present study indicate that adolescent rats with social anxiety (SA) exhibit significantly higher levels of compulsive behavior than control rats.
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Vagotomy Correlates

- The results of the present study indicate that adolescent rats with social anxiety (SA) exhibit significantly higher levels of compulsive behavior than control rats.
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- The results of the present study indicate that adolescent rats with social anxiety (SA) exhibit significantly higher levels of compulsive behavior than control rats.

Future Directions

1. Evaluate the effects of Bifido on other measures of social anxiety and compulsive behavior.
2. Evaluate the effects of Bifido on other measures of social anxiety and compulsive behavior.
3. Evaluate the effects of Bifido on other measures of social anxiety and compulsive behavior.

Assessment of Vagotomies

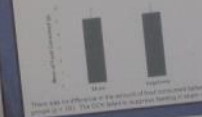
Background

• Vagotomy is a procedure that involves the removal of the vagus nerve, which is a major component of the parasympathetic nervous system.

• Vagotomy is a procedure that involves the removal of the vagus nerve, which is a major component of the parasympathetic nervous system.

• Vagotomy is a procedure that involves the removal of the vagus nerve, which is a major component of the parasympathetic nervous system.

Results:



There were no significant effects of any treatment on the amount of time spent in the open field or in the center.

A woman in a blue button-down shirt is speaking and gesturing with her right hand while holding a purple water bottle with a white butterfly logo. She is looking towards the poster and the audience.

A woman with long dark hair and glasses is listening to the speaker. She is wearing a denim jacket and has a brown bag strap over her shoulder.

The back of several audience members' heads is visible in the foreground, showing they are looking towards the poster.



Cross Generational Effects of *Bifidobacterium infantis* 35624 on the Maternal Restraint Model of Depression

Sarah Barker and Lori Driscoll
The Colorado College, Colorado Springs, CO



Method

Animals

- Female Long Evans (Rattus norvegicus) rats (N = 18) were paired with male rats (N = 18) for eight days
- Pregnant dams (N = 13) were housed in individual cages
- Two to four pups from each litter were randomly selected for behavioral testing

Maternal Restraint

- Half of the dams were restrained for 45 minutes, 3x/week beginning on prenatal day 14 and concluding after delivery (n = 13)



Probiotic Supplementation

- Daily supplementation with over-the-counter 40g (1 x 10¹⁰ cfu) of *Bifidobacterium infantis* 35624 began on the first day following breeding in half of the dams (n = 6)
- Pups of dams who received probiotics continued to receive daily supplementation throughout the experiment (n = 18)

Forced Swim Test (FST)

- The FST is designed to assess depressive behavior in rats and is sensitive to anti-depressant manipulations
- Immobile behavior, in contrast to climbing or swimming, is indicative of depression
- Dams (pre and post part) and offspring were administered the FST procedure
- FST videos were coded by two independent raters blind to the conditions with established inter-rater reliability (Cronbach's $\alpha = .87$) for percentage of time spent immobile



Fig. 1. Characteristic behavior in the FST

Weight

- Dams were weighed together from PND3-PND21
- Litters were weighed together from PND3-PND21 to completion of lactation

Results

Maternal Outcomes

- Maternal restraint did not significantly decrease pup or dam weight gain
- Supplementation with *Bifidobacterium infantis* 35624 did not significantly increase weight gain in dams



- Maternal restraint did not significantly decrease pup or dam weight gain
- Supplementation with *Bifidobacterium infantis* 35624 did not significantly increase weight gain in dams

Offspring Outcomes

- Probiotic-treated offspring did not show significant increased depressive behavior
- Supplementation with *Bifidobacterium infantis* 35624 did not significantly decrease depressive behavior in offspring



- Probiotic-treated offspring did not show significant increased depressive behavior
- Supplementation with *Bifidobacterium infantis* 35624 did not significantly decrease depressive behavior in offspring

contrasting, poor sleep and ...
only 20% of these seek ...
nutrition, increased ...
of neurotransmitters ...
birth weight, decreased head ...
increased risk of depression ...
reuptake inhibitors (SSRIs) ...
safety for fetus ...
ation between microbiota in the gut ...
system ...
th and immune status influence brain ...
influences microbiota and ...
disrupts maternal microbiota and ...
assessed to the child (Zijlmans, Korpela, ...
Vos, & Weerth, 2015) ...
clinical trials show promising results for ...
treatment for depression ...
nt would increase depressive behavior in ...
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behavior ...
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ation with *Bifidobacterium infantis* 35624 would ...
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y 35624 would ...



**Bacterium inhibits 3561A Suppression of Influenza
Rats Does Not Influence Amount of Amantadine**

Paige E. Arnold, M.S., DVM
Laboratory of Bacteriology
The Colorado State University

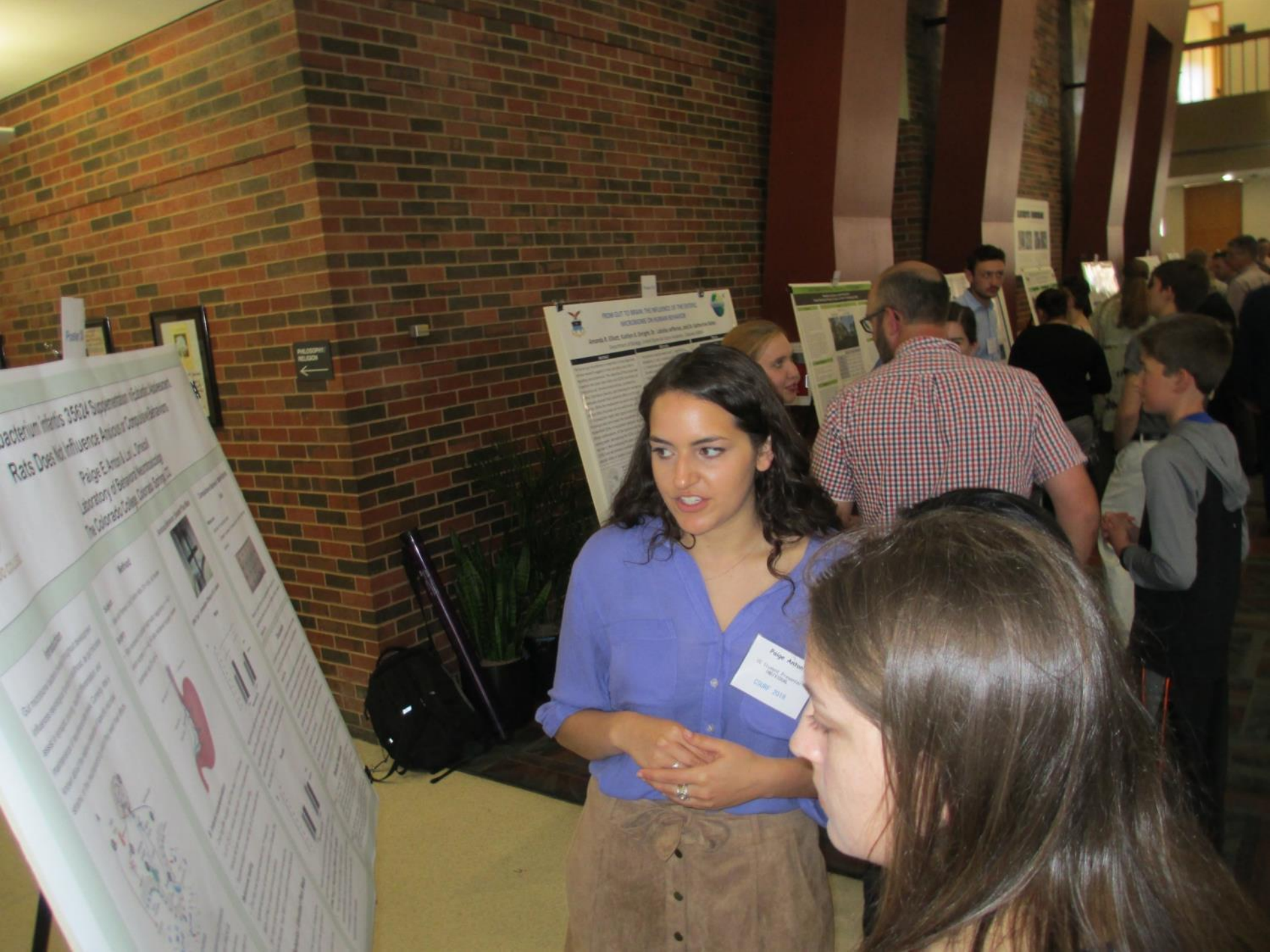


**FROM GUT TO BRAIN: THE IMPACT OF THE GUT
MICROBIOME ON BRAIN BEHAVIOR**

Araceli A. Chao, Karim A. Jorgel, Jr., John A. Jorgel, Jr., and John A. Jorgel, Jr.
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CSU 2018

PLEASE
REMAIN
←



Long-term dendritic and spine changes following repetitive traumatic brain injury

Allysa P. Warling¹, Madeleine E. Garcia¹, Noah Beckett Shea-Shumsky¹, and Bob Jacobs¹
¹Laboratory of Quantitative Neuromorphology
Neuroscience Program, The Colorado College, Colorado Springs, CO, 80903



Allysa P. Warling, a young woman with long brown hair, is wearing a green jacket over a white dress. She is standing in front of the poster and looking towards the right. She has a name tag on her jacket that reads 'Allysa P. Warling'.

A woman with long, curly brown hair is wearing a blue and white floral patterned top. She is standing to the right of Allysa, looking at the poster and talking to her.

Generational Effects of *Bifidobacterium infantis* 35624 on the Maternal Restraint Model of Depression




Sarah Barker and Lori Driscoll
The Colorado College, Colorado Springs, CO

Animals

- Female Long Evans (*Rattus norvegicus*) rats (N = 16) were paired with male rats (N = 16) for eight days.
- Pregnant dams (N = 13) were housed in individual cages.
- Two to four pups from each litter were randomly selected for behavioral testing.

Maternal Restraint

- Half of the dams were restrained for 45 minutes, 3x/week beginning on prenatal day 14 and concluding after delivery (n = 13).



Probiotic Supplementation

- Daily supplementation with over-the-counter Align (1 x 10¹⁰ cfu of *Bifidobacterium infantis* 35624) began on the first day of breeding in half of the dams (n = 8).
- Pups of dams who received probiotic continued to receive daily supplementation throughout the experiment (n = 16).

Forced Swim Test (FST)

- The FST is designed to assess depressive behavior in rats and is sensitive to anti-depressant manipulations.
- Immobile behavior, in contrast to climbing or swimming is indicative of depression.
- Dams (pre and post natal) and offspring were administered the FST procedure.
- FST videos were coded by two independent raters blind to the FST procedure.
- FST videos were coded by two independent raters blind to the conditions with established inter-rater reliability (Cronbach's $\alpha = .87$) for percentage of time spent immobile.




Fig. 1. Characteristic behaviors in the FST.


Weight

- Dams were weighed daily throughout pregnancy.
- Litters were weighed together from PND6-PND21.
- Individual pups were weighed every four days from PND1 to completion of experiment.

Method

Maternal Outcomes

- Maternal restraint significantly increased post-partum FST immobility time ($p < 0.05$).
- Supplementation with *Bifidobacterium infantis* 35624 did not reduce depressive behavior.



Offspring Outcomes

- Maternal restraint did not significantly decrease weight gain during pregnancy.
- Supplementation with *Bifidobacterium infantis* 35624 did not significantly increase weight gain in dams.
- Prenatally stressed offspring did not show significantly increased depressive behavior.
- Supplementation with *Bifidobacterium infantis* 35624 did not significantly decrease depressive behavior in offspring.

Results

Discussion

Maternal Outcomes

- Maternal restraint procedure successfully induced depressive behavior in dams.
- Bifidobacterium infantis* 35624 supplementation marginally increased depressive behavior, as seen in previous research (DeBruin et al., 2010).
- No change in weight gain was seen.

Offspring Outcomes

- Female offspring showed a trend in depressive behavior consistent with the hypotheses.
- Stress and probiotic effects on weights decreased from PND21, in accordance with previous research.
- After weaning, male offspring who underwent prenatal stress weighed less than control groups.
- Supplementation marginally reduced the decreased weight.

Limitations

- Small sample size.
- Maternal restraint procedure only performed for six to seven days.

Conclusions

- A better treatment option for prenatal depression is needed.
- The present study is the first to test the effects of probiotic supplementation on the maternal restraint model of depression.
- Although our results reached statistical significance, trends in the data in accordance with the hypotheses were seen.
- Based on the present and previous studies, further research is warranted.

Future Directions

- Repeat current study with larger sample size.
- Repeat current study with an interval strain.
- Sex type neither in development.
- Ensure that offspring are not given probiotic supplementation if they do not weigh more initially.
- Specify the micro-organisms used in antibiotics.

Selected References

DeBruin, L., Corral, L., Dyer, D., Kelly, B., Tjebk, J. & Sloan, T. (2010). Effects of prenatal *Bifidobacterium infantis* 35624 on the maternal restraint model of depression. *Behavioral Neuroscience*, 123, 1179-1188. <https://doi.org/10.3758/bn.123.4.1179>

Dryden, M. A., Ford, T., & Papadimitrakou, F. (2008). Probiotic supplementation and anxiety: Depression. *PLoS ONE*, 3, e2544. <https://doi.org/10.1371/journal.pone.0025444>

Epstein, M. A., Garg, A., & Walker, L. M. (2014). Maternal restraint stress in pregnancy and the impact on offspring. *Psychoneuroendocrinology*, 39, 212-224. <https://doi.org/10.1016/j.psyneuen.2013.11.008>



Sarah Barker
The Colorado College
Colorado Springs



Poster 36



Long-term dendritic and spine changes following repetitive trauma injury

Allysa P. Waring¹, Madeleine E. Garcia¹, Noah Beckett Shea-Shumsky¹, and E. ...
¹Laboratory of Quantitative Neuromorphology
Neuroscience Program, The Colorado College, Colorado Springs, CO, 80903

Abstract

Repetitive trauma from injury (RTBI) is a risk factor for the neurodegenerative disease chronic traumatic encephalopathy (CTE). The associated pathology being seen changes in dendritic structure of total and specific layer pyramidal neurons following RTBI in areas with and without CTE diagnoses. Tissue from a mouse with a history of RTBI, five with CTE diagnoses and one without, was compared to tissue from 12 neurologically normal individuals (Smith et al., 2007). Tissue was processed with a modified rapid Golgi technique and dendritic systems were analyzed using computer-assisted morphometry. Mean quantitative dendritic and spine measures were determined for each cortical region in all post-RTBI tissue in comparison to control tissue representing CTE diagnosis. The post-trauma cortex was more severely affected than the control cortex. Surviving dendritic branches following RTBI had a higher population for cognitive functions, with an absence of neurodegenerative diagnosis.

Introduction

Repetitive trauma from injury (RTBI) may have enduring neural consequences, including affecting the brain of CTE, a tau protein-related neurodegenerative disorder (Smith et al., 2013). The structure of cortical pyramidal dendritic systems, which are vital for cognitive processes (Wise et al., 2010), have been found to be altered (Cassidy et al., 2004). However, previous work on the enduring effects of RTBI was CTE tissue, which is composed of macroscopic gray and white matter. Cognitive decline follows that on the structural measures of dendritic systems. To that end, this study quantifies the long-term dendritic and spine changes in RTBI in areas with CTE and without, in the frontal and occipital cortex.

These changes in the executive functions, and the occipital pole, which is involved in visual spatial processing. Morphological changes in the frontal pole to a great extent were seen when Cassidy et al. (2004) the evaluation of the frontal cortex, including dendritic spine density, and dendritic spine length or repetitive brain trauma, and how this is related to CTE in some cases. The study is greatly impacted by the RTBI severity, in the chronic, duration of

long-term brain trauma following RTBI. Cassidy et al. (2004) showed that a morphological change in the frontal cortex of the visual cortex was seen in RTBI tissue. The frontal cortex is a region of the brain that is involved in executive functions, and spine density is a measure of cognitive function. The study is greatly impacted by the RTBI severity, in the chronic, duration of

Subjects

Tissue from six male subjects ($M_{age} = 72 \pm 12$ years) with a history of RTBI was obtained from the Boston University CTE Center (Boston, MA). The combined RTBI/CTE group, known to be the CTE group. CTE was diagnosed using NINDS-NIBIB criteria. One subject was at stage 0 (i.e., no CTE), one subject was at stage III (i.e., early CTE), and four subjects were at stage III or IV (i.e., late CTE).

Methods

An age-matched sample of 12 neurologically normal subjects ($M_{age} = 72 \pm 6$ years) from a previous study (Smith et al., 2007) acted as a control cohort.

Tissue Preparation

Cerebral tissue generally corresponding to Brodmann's area (BA) 10 and BA 18 (Fig. 1) was stained using a modified rapid Golgi technique and serially sectioned at 100 μ m with a vibratome.

Neuron Selection and Quantification

Superficial pyramidal neurons in the CTE group were traced under a 60x oil objective; neurons in the control cohort were traced under a 40x dry objective. Basilar and apical dendritic arbors were quantified for the CTE group, but only basilar dendrites were included for the control group. Neurons in a 400 \times CTE group ($n=24$), control group ($n=24$) were quantified in a NeuroLucida system (MBF Bioscience, Inc.).

Dependent Measures

Neurons were quantified with five established measures: total dendritic length (TDL), mean segment length (MSL), dendritic segment count (DSC), dendritic spine density (DSD), and dendritic spine number (DSN). Spine depth and surface area were also recorded.

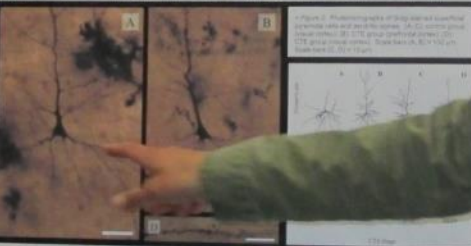


Figure 1. Schematic of the brain showing the location of the cortical regions BA 10 and BA 18. The regions were stained using a modified rapid Golgi technique and serially sectioned at 100 μ m with a vibratome. A-F: Photomicrographs of Golgi-stained superficial pyramidal neurons and their dendrites. A-C: control group (mean \pm SEM). D-F: CTE group (superficial cortex). D-F: CTE group (occipital cortex). Scale bars: A, B, 100 μ m; C-F, 20 μ m.

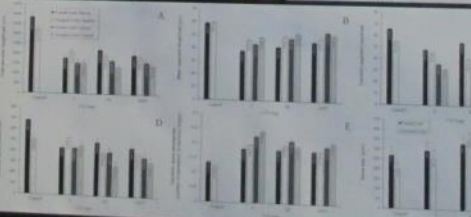
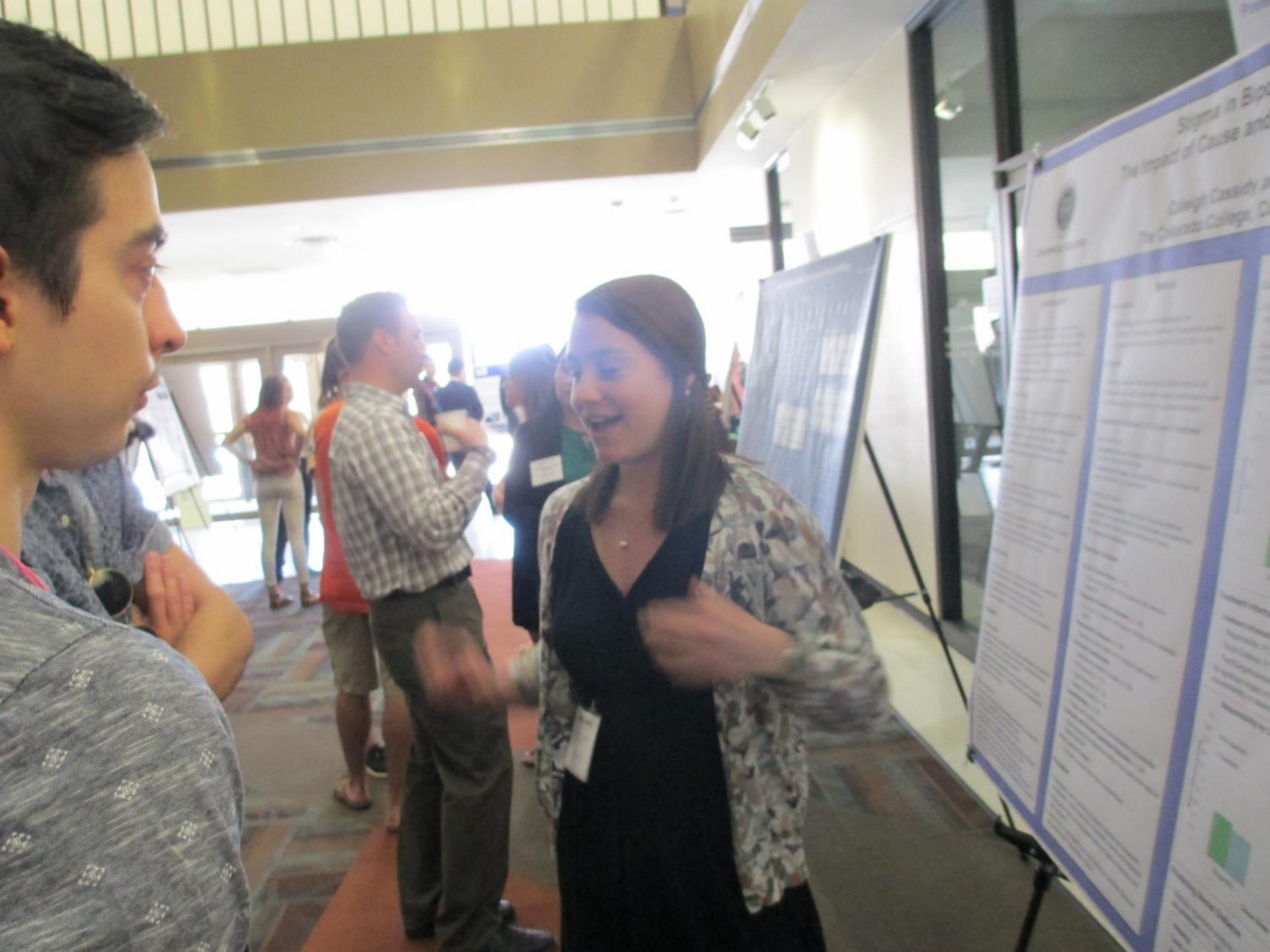


Figure 2. Quantitative measures of dendritic and spine changes in the frontal and occipital cortex. The graphs show the mean \pm SEM for each measure. The y-axis represents the measure, and the x-axis represents the cortical region and group. The measures are TDL, MSL, DSC, DSD, and DSN. The CTE group shows significantly higher values for all measures compared to the control group.

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CSPP 2018



Poster 16

The Difficulty Principle: Perceptual Discrimination Depends on Difficulty



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Experiment 1a - Results

Difficulty Principle supported in accuracy data for hit in within-category trials.

Positive exponential trend in accuracy observed for hit in Experiment 1a (30.2% vs. 32.2%), consistent with the greater perceptual similarity of the blue/red stimuli. Improving this across difficulty on between-category trials result accuracy on within-category trials on particular distance units (2, 4) produced a near negative slope ($M = -2.27$ and $SD = 2.1$) that differed significantly from zero, $t(17) = 4.50, p = .001$.

Experiment 1b - Results

Difficulty Principle supported in accuracy data for hit in within-category trials.

Positive exponential trend in accuracy observed for hit in Experiment 1b (30.2% vs. 32.2%), consistent with the greater perceptual similarity of the blue/red stimuli. Improving this across difficulty on between-category trials result accuracy on within-category trials on particular distance units (2, 4) produced a near negative slope ($M = -2.27$ and $SD = 2.1$) that differed significantly from zero, $t(17) = 4.50, p = .001$.

Experiment 2 - Results

A repeated measures ANOVA was conducted on the RT data with visual field (LEFT/RIGHT), categorical relationship (within/between-category), and perceptual distance (2, 4, 6, 8) as factors.

Supporting the Difficulty Principle, there was an interaction between perceptual distance and categorical relationship, $F(3, 17) = 4.35, p = .02, \eta^2 = .18$.

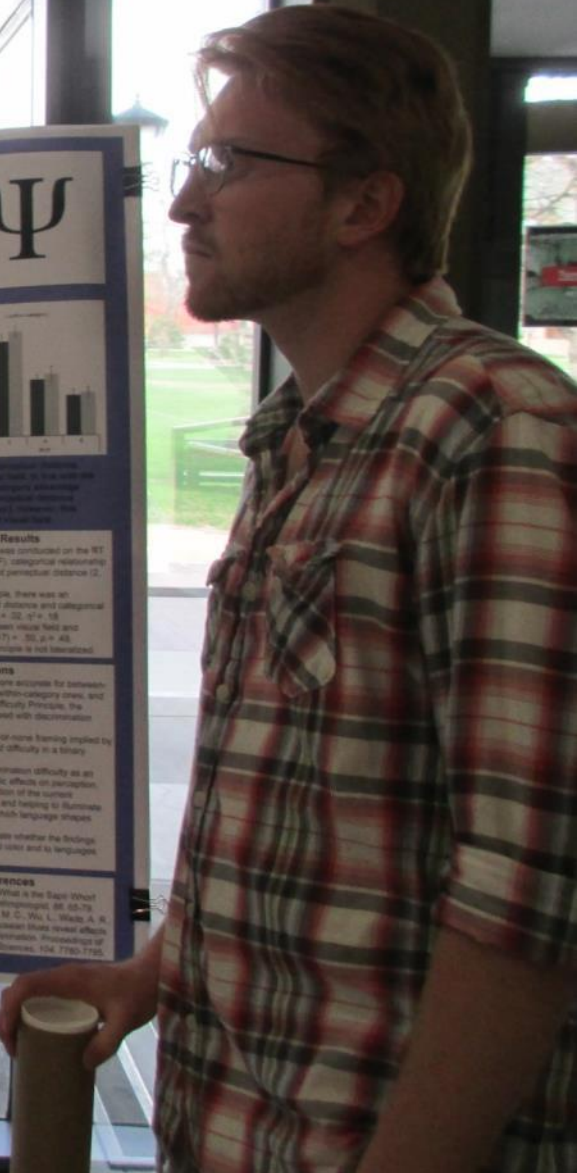
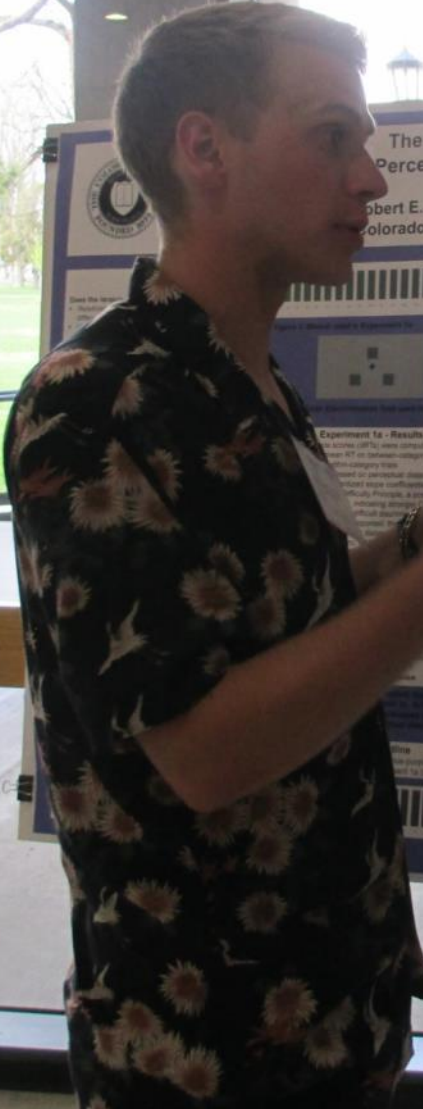
There was no interaction between visual field and categorical relationship, $F(3, 17) = .35, p = .48$, indicating that the Difficulty Principle is not lateralized.

Conclusions

- Participants were faster and more accurate for between-category discriminations than within-category ones, and critically, consistent with the Difficulty Principle, the magnitude of this effect increased with discrimination difficulty in a graded manner.
- These findings contrast the all-or-none framing implied by previous studies that measured difficulty in a binary manner.
- These findings highlight discrimination difficulty as an important measure of linguistic effects on perception, providing a potential reevaluation of the current theoretical perspectives in the literature, and helping to illuminate the precise conditions under which language shapes perception.
- Future research should investigate whether the findings extend to other domains beyond color and to languages other than English.

Selected References

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- Winters, J., Wilbur, N., Frank, M. C., Yiu, L., Mitsu, A. & Bonvillian, J. (2007). Research shows reveal effects of language on color discrimination. *Proceedings of the National Academy of Sciences*, 104, 7780-7785.



Poster 15

Co-treatment with *Bifidobacterium infantis* Reduces Anxiety but Does Not Affect Compulsive Behavior in Adolescent Rats

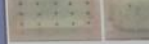
Dr. L. L. Driscoll
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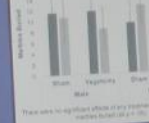
Marble Burying Task

- 12-16 weeks old (PND 21-28) of female rats
- All three fed on an identical regimen of standard chow
- Rats fed the probiotic or not were not different in any other way

Initial Apparatus Setup: Example of a Paved Task



Results



There were no significant effects of any treatment on the number of marbles buried (all $p > .05$).

Assessment of Vagotonics

Phenylephrine (PEH) is a potent α_1 -adrenoceptor agonist that induces a vasoconstrictive effect on the heart. COX-2 inhibition reduces the vasoconstrictive effect of PEH in the heart. The aim of this study was to determine if COX-2 inhibition in the heart is affected by the probiotic treatment.



There were no differences in the heart rate of the rats between the groups (all $p > .05$). The α_1 -adrenoceptor agonist PEH had no effect on heart rate (all $p > .05$).

Discussion

The present study was designed to determine if the probiotic *Bifidobacterium infantis* could affect anxiety and compulsive behavior in adolescent rats. The results of the present study indicate that the probiotic treatment reduced anxiety but did not affect compulsive behavior. This suggests that the probiotic treatment may affect anxiety but not compulsive behavior in adolescent rats.

Future Directions

- Evaluate the effects of the probiotic treatment on anxiety and compulsive behavior in adolescent rats with a different probiotic strain
- Evaluate the effects of the probiotic treatment on anxiety and compulsive behavior in adolescent rats with a different probiotic strain
- Evaluate the effects of the probiotic treatment on anxiety and compulsive behavior in adolescent rats with a different probiotic strain

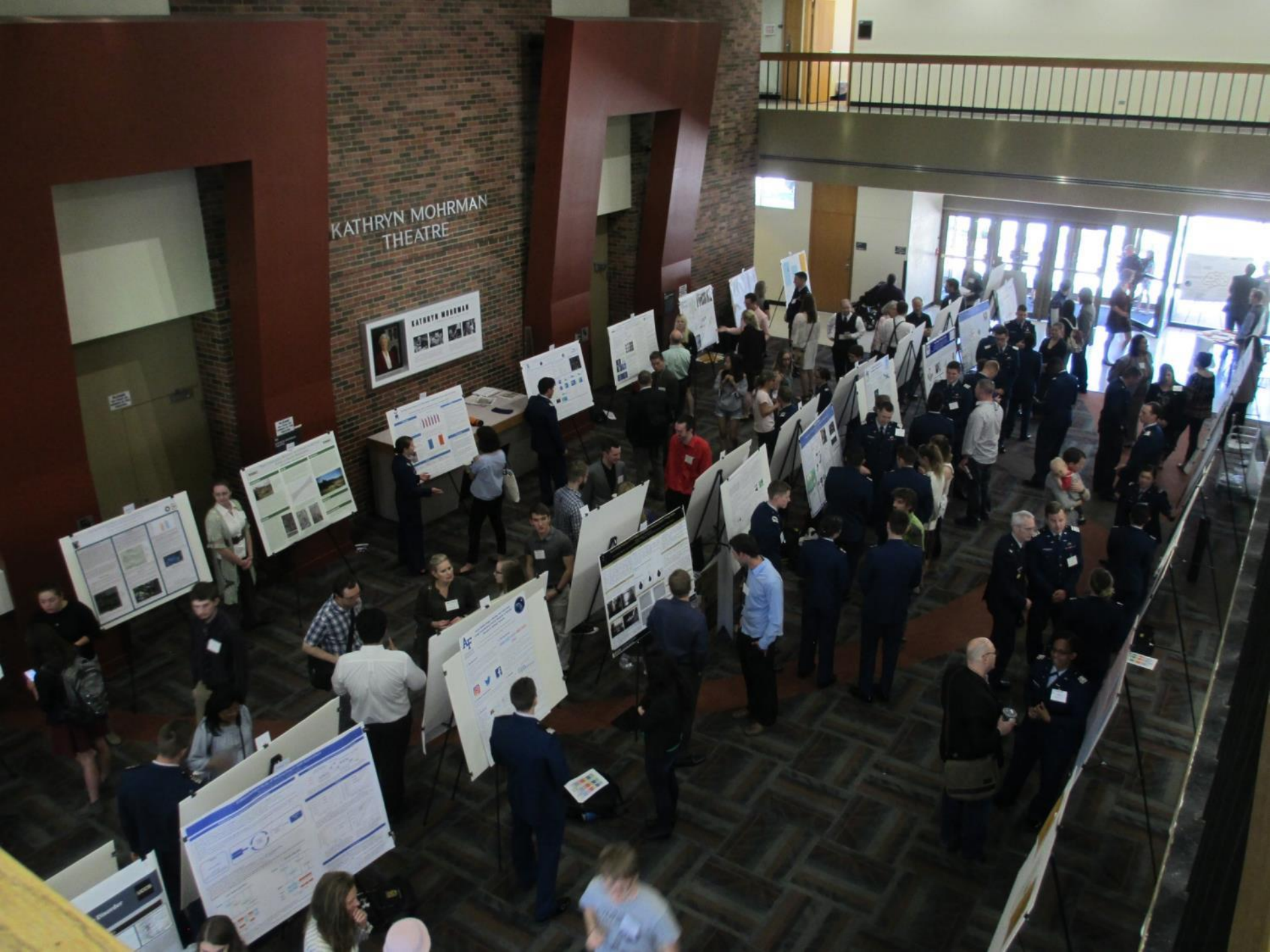
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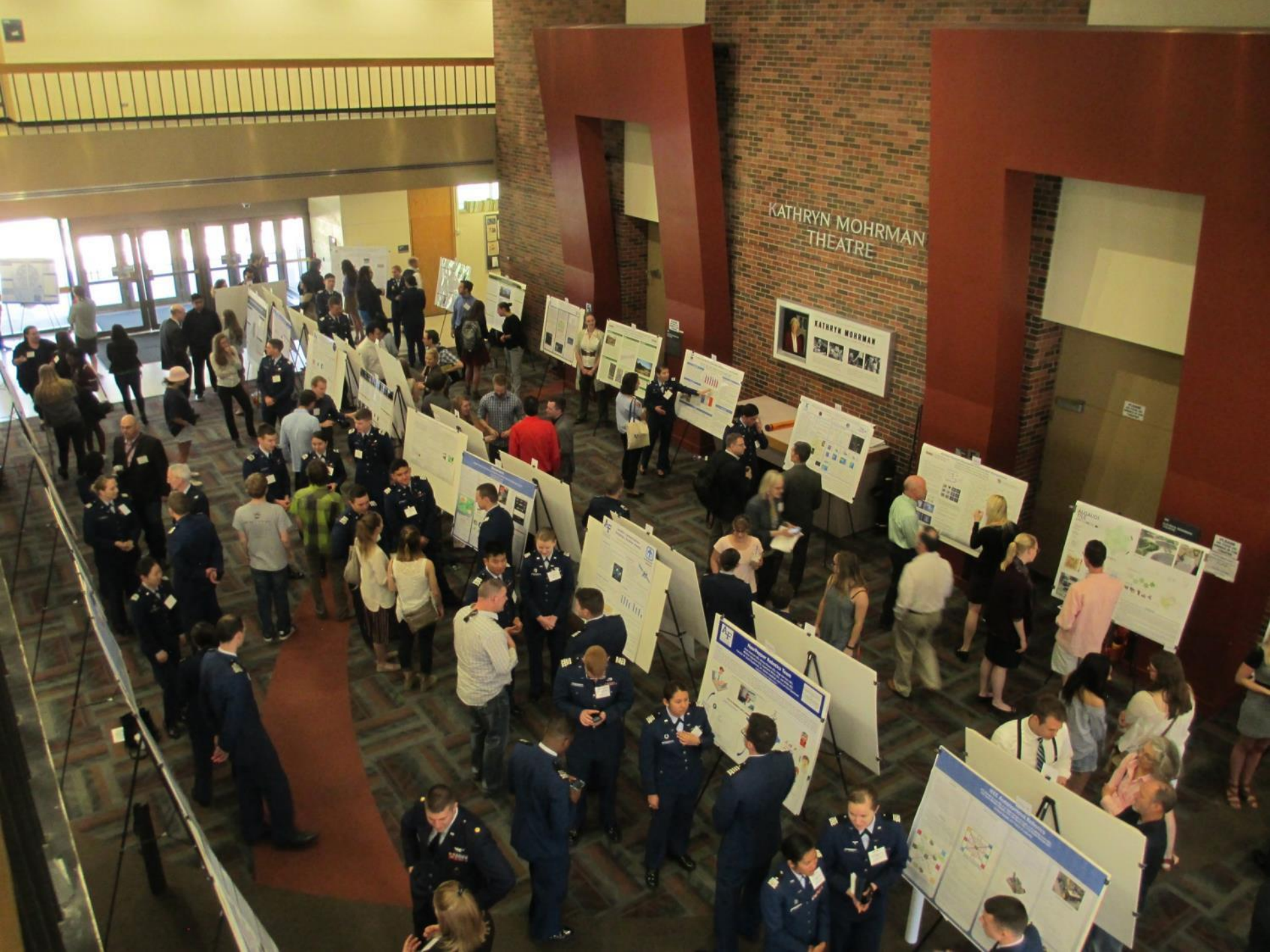
Smith, D. P., Park, S. J., Smith, M. L., & Driscoll, L. L. (2014). The probiotic *Bifidobacterium infantis* reduces anxiety but does not affect compulsive behavior in adolescent rats. *Behavioral Brain Research*, 264, 1-10.

Smith, D. P., Park, S. J., Smith, M. L., & Driscoll, L. L. (2014). The probiotic *Bifidobacterium infantis* reduces anxiety but does not affect compulsive behavior in adolescent rats. *Behavioral Brain Research*, 264, 1-10.



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THEATRE





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