Expression of Ssr2 in a Mouse Model of Congenital Hypopituitarism

Arnold Ukagwu, Pratyusa Das, Buffy Ellsworth PhD
Department of Physiology, Southern Illinois University at Carbondale

Figure 1. The pituitary is crucial for the maintenance of various homeostatic functions including growth, metabolism, and reproduction. The pituitary gland consists of three lobes. The anterior, posterior, and intermediate lobes. This lobe produces six hormones: growth hormone (GH), thyroid stimulating hormone (TSH), adrenocorticotropic hormone (ACTH), a follicle stimulating hormone (FSH), luteinizing hormone (LH) and prolactin.

Figure 2. FOXO1 may regulate Ssr2 expression. We have found that Foxo1 binds to the gene for Ssr2, suggesting that FOXO1 may regulate expression of the Ssr2 gene. This may be one aspect explaining how FOXO1 regulates somatotroph differentiation. Linear representation of ChIPseq data for the Ssr2 gene. ChIPseq data for Foxo1 and input samples are shown at the top. Rat gene structure from Integrative Genomics Viewer (IGV) is at the bottom. IGV gene features include introns in thin blue lines and exons as thick lines. Arrows indicate the direction of gene transcription.

Results

Figure 5. SSR2 is present in anterior pituitary gland. Coronal section were used in IHC to label SSR2 (green). DAPI (blue) was used to label the nucleus. We find that SSR2 is present in the anterior pituitary, but not in the intermediate or posterior lobes. This image was taken at 100x.

Conclusion

- Ssr2 is present in anterior pituitary gland.
- SSR2 is visibly reduced in DKO mice.
- Expression of Ssr2, which may be one aspect to explain how FOXO1 regulates somatotroph differentiation in congenital hypopituitarism.

References


Acknowledgements

This work has been funded by the McNairs Scholars Program, NIH(R15HD078885), and SIU School of Medicine Research Seed Grant. Special thanks to SIU Medicine (Dr Buffy Ellsworth, Pratyusa Das) and Rhetta Seymour.
Introduction

Cell walls are made up of a complex and dynamic network of polysaccharides and other polymers that are involved in several vital functions such as imparting mechanical strength, withstanding turgor pressure, signaling, nutrient transport and biotic and abiotic stress responses (Cosgrove 2005). Studies have shown that osmotic stress and drying impact the composition of cell walls (Vicente et al. 2005). It has also been demonstrated that food-conducting cells in leptoids of *Polytrichum commune* form wall ingrowths when drying occurs. When rehydrated, these wall ingrowths disappear (Pressel et al. 2006). The present study was designed to follow-up on Pressel et al. (2006) by examining cell wall constituents of food-conducting cells of this moss before and after dehydration.

Materials and Methods

**Specimen preparation:** Stems were fixed overnight in 3% glutaraldehyde in 0.5M phosphate buffer pH 7.2, rinsed 3 times in buffer for 15 minutes each. Plants were post-fixed in osmium tetroxide and rinsed with autoclaved water. Specimens were dehydrated in a graded ethanol series, embedded in LR white resin, cured at 65°C, and sectioned with an ultramicrotome. Monitor sections were stained with toluidine blue and imaged on a light microscope.

**Immunogold labeling:** Sections were collected on 200 mesh Ni grids, blocked in BSA/PBS, and put into one of four primary antibodies overnight. Following four washes BSA/PBS, grids were placed in the secondary antibody, rinsed and dried. Grids were observed on a TEM at the IMAGE center and digital pictures captured.

**Results**

<table>
<thead>
<tr>
<th>Pectins</th>
<th>Hemicelluloses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abundant labels</td>
<td>Abundant labels</td>
</tr>
<tr>
<td>Short chain arabinan</td>
<td>Long chain arabinan</td>
</tr>
<tr>
<td>LM6 Control</td>
<td>LM6 Treatment</td>
</tr>
<tr>
<td>Scattered labels</td>
<td>No labels</td>
</tr>
<tr>
<td>LM13 Control</td>
<td>LM13 Treatment</td>
</tr>
<tr>
<td>Abundant labels</td>
<td>Abundant labels</td>
</tr>
<tr>
<td>LM21 Control</td>
<td>LM21 Treatment</td>
</tr>
<tr>
<td>Mannan</td>
<td>Abundant labels</td>
</tr>
<tr>
<td>LM25 Control</td>
<td>LM25 Treatment</td>
</tr>
<tr>
<td>Hemicellulose</td>
<td>Xyloglucan</td>
</tr>
<tr>
<td>Abundant labels</td>
<td>Abundant labels</td>
</tr>
</tbody>
</table>

**Discussion**

Pectins provide porosity, elasticity, and flexibility to cell walls (Table 1) and have been implicated as the wall polymers that are affected most significantly when plants undergo significant drying (Vicente et al. 2005). Of the two antibodies (LM6 and LM13) used in this study to localize pectins, only LM13 showed changes from being present in controls to absent after drying. Labeling with the LM6 antibody was abundant in both controls and treatment. The LM6 antibody recognizes short chains of arabinan on the pectin molecule, while LM13 recognizes long chains of arabinans. Labeling was not changed for either hemicellulose antibody (LM21 and LM25) in controls and dried plants. Mannan-containing hemicelluloses are labeled with LM21 and they are known to be involved in hydration and dehydration cycles and nutrient uptake (Table 1). Xyloglucans, localized with the LM25 antibody, give the cell wall expansibility and tethering properties (Table 1).

**Conclusion**

Of the four antibodies used in this study, changes were seen only in the pectin antibody that recognizes side chains made of numerous arabinans (LM13). It is possible that drying disrupted the long arabinan side chains converting them to short chains. This work is preliminary and suggests there are modifications in food-conducting cell walls in mosses after dehydration.

**Future Research**

I will conduct additional dehydration experiments using conditions that are more in line with the physiology of mosses such as drying for extended periods at ambient temperatures. This approach may lead to more conclusive results that parallel the plant’s response to drying in the natural environment. Future work will also concentrate on additional cell wall polymers such as arabinogalactan proteins that have been shown to play an essential role in wall response to osmotic (water) stress.

**Literature Cited**


**Acknowledgements**

This work was supported by the SIU McNair Scholars and SI Bridges Programs. We thank Rhetta Seymour, Fanny Mazna, William Browning and Drs. Laxmi Sagwan-Barkdoll and Renee Lopez-Swall for valued assistance.

**Table 1:** Cell wall polymers and select properties (Henry et al. 2020).

<table>
<thead>
<tr>
<th>Cell wall polymer</th>
<th>Cell wall properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>RG1 Pectin - Arabinan</td>
<td>Flexibility, Porosity, Expandability, Elasticity</td>
</tr>
<tr>
<td>Hemicellulose - Xyloglucan</td>
<td>Expansibility, Cell-to-cell adhesion, Cross linkage, Tethering</td>
</tr>
<tr>
<td>Hemicellulose - Mannans</td>
<td>Nutrient uptake, Hydrated/dehydrated cycles</td>
</tr>
</tbody>
</table>

No changes in labeling were visible between controls and dehydrated plants, except for with LM13 (outlined in red), a pectin antibody that recognizes long chains of arabinans. Arrows point to gold labels. Bars = 50 μm.
An Exploration of the Digestibility of Proteins using a Modified Three-Step in Vitro Procedure
Leah Hall and Faculty Mentor: Dr. Amer AbuGhazaleh
Southern Illinois University-Department of Animal Science

Abstract
A ruminant animal with a Cannula port was used in addition to a modified version of a well-known in vitro procedure in hopes of reducing the associated cost and labor required to investigate the intestinal digestion of proteins within various feeds. Nylon bags were used to incase the feed samples, crucial for allowing protein digestion within the rumen without degradation of the bag or disruption of the remaining Amino Acids. The experiment was conducted by allowing protein samples to incubate in the rumen of a canulated cow for 16 hours to estimate Rumen Degradable Protein (RDP) and Rumen Undegradable Protein (RUP). The RUP portion was then incubated in Daisy jars in a liquid solution containing different proteolytic enzymes to simulate the environment of the small intestine to estimate intestinal protein digestion of different commercial protein sources. The results showed that the hypothesis of the researchers was supported, and that the modified in-vitro procedure could be used to simulate the small intestine when determining protein digestion. The average protein sources and digestability levels were found for each feed sample and recorded in the results.

MATERIALS:
- Small aluminum tin trays
- Scale
- Water
- amylase enzyme
- Diffusible Nylon bags
- LECO N analyzing machine
- DAISY Incubator
- Large Glass jars
- Cannula port cable
- Zip Ties

Methodology

Pre-Rumen Digestion
Specialized bags (Dacron bags) were prepped and filled with a similar amount (grams) of various protein sources. Each bag was placed in the cow’s rumen after being attached to a specialized cord designed to allow entry and exit via the cannula port more reliably. The samples were then left there for sixteen hours to allow for adequate digestion and consistency of time length between each protein source being tested. It was necessary to dry each sample, weigh them, and measure the protein in the feed prior to digestion using the LECO analysis machine to collect data on the existing protein percentage that could be compared with the samples post-digestion. Lastly, the bags were removed from the rumen, washed several times with cold water to remove bacteria, and then returned to the lab for further analysis.

Post Rumen Digestion
After the protein samples were retrieved from the rumen, they were analyzed using the LECO N analyzer to determine how much of the initial protein was remaining after the sixteen-hour period. Based on how much of the protein was intact, it was then determined how much of the original sample could be categorized as either RDP or RUP. After identifying the Rumen Undegradable Protein, the remaining proteins (RUP fraction) were incubated for 24 hours in buffer solutions containing pepsin and pancreatin enzymes that was rotated 360° continuously within the DAISY incubator machine to estimate the intestinal protein digestion under in vitro conditions.

Results
The results of this experiment concluded the average percentage of protein digestion that would occur in both the rumen and small intestine for various commercial cattle feeds. It was found that the modified in-vitro procedure could adequately replicate the conditions of the small intestine when replicated using an α-amylase enzyme solution.

<table>
<thead>
<tr>
<th>Sample Name</th>
<th>Average Crude Protein (%)</th>
<th>Average Rumen Undegradable Protein (%)</th>
<th>Average Rumen Degradable Protein (%)</th>
<th>Average RUP Digestion in Amylase Enzyme</th>
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<tr>
<td>1</td>
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<td>5</td>
<td>45.00</td>
<td>51.85</td>
<td>52.34</td>
<td>96.78</td>
</tr>
</tbody>
</table>

Table 1: Shows the results collected from four sample sets to determine the average sample crude Protein, RUP, and RDP levels. It also shows the average percentage of digestion that would take place in the small intestine.

Conclusion
Studying the nutritional components of commercial feeds is crucial in determining feed rations and keeping the animals healthy. Knowing the levels of RUP and RDP helps to ensure that rumen microbes within a cow’s digestive system are thriving and functioning as they should. This experiment while not new in its design, held a practical and “real world” importance that added to its significance. The data collected will be passed on to the feed company so that it can be used to further their understanding of their product and improve in areas where necessary. Future studies could explore different areas of nutrition and expand to test different variables and their impact on digestion.

References

This research was sponsored by the Southern Illinois University McNair Scholars Program.
Introduction

Hemp (Cannabis sativa L.) has been cultivated since ancient times, and is harvested for its seeds, oil, fiber, and medicinal properties. Hemp production is growing, and the market value of hemp is expected to increase. However, basic agronomic information is lacking since the 1970 Controlled Substances Act prohibited hemp cultivation until the 2014 and 2018 Farm Bills (H.R.2 2018). As with any cultivated crop, weed control is considered one of the most important factors in crop success, and hemp appears to be most affected by weeds in the seedling stage, making a weed free field desirable for planting hemp (Gage, unpublished). However, the use of herbicide to prepare a weed free field in “burndown” applications may affect the germination of hemp seeds. Currently, the herbicide glyphosate (Roundup®) is the most used herbicide, worldwide and is often used in burndown applications. While glyphosate is promoted as having no residual activity in the soil after application (Roundup® PowerMaxX3 2020), sensitivity of germinating seeds has been documented for other crops (Helander et al. 2019). Initial observations suggest that hemp appears to be highly sensitive to glyphosate, compared to surrounding weeds vegetation, and therefore, sowing of hemp seed may require a waiting period between glyphosate burndown application and planting.

The objective of this study is to determine the sensitivity of germinating hemp seeds to glyphosate at various planting timings following glyphosate application, testing the null hypotheses: There is no difference in sensitivity of hemp at any planting date following a glyphosate application. An understanding of hemp production and glyphosate usage will become increasingly important information to add to knowledge of best management practices for hemp growers.

Materials and Methods

➢ A benchtop germination study was conducted at the SIUC Horticultural Research Center using seeds of the hemp cultivar ‘Jinma’ under supplemental lighting at 200 µmol/m²/sec.

➢ A mixture 1:1:1 of field soil, sand, and a peat mixture was placed in each of six cells of a 601 tray (Fig. 1). Each cell was a treatment, and there were six trays, or replicates.

➢ Glyphosate (Roundup PowerMax®) application was made in an herbicide spray chamber to deliver a uniform, controlled application to all treatments. The typical glyphosate burndown use rate of 32 fl. oz/ac was applied. The control cell in each tray was removed prior to spraying to prevent glyphosate application. The remaining cells received an application of glyphosate at the same time.

➢ Twenty hemp seeds were planted at a 0.25” depth at 0, 3, 6, and 12 Days After Application (DAA) of glyphosate in a randomly assigned, pre-labeled cell (Fig. 1). Initially a 24 DAA planting was planned but was later deemed unnecessary.

➢ Hemp seeds germinate within three days of planting under optimal conditions, so counts of live and dead seedlings were taken at 5 and 10 Days After Planting (DAP).

➢ Data analysis was conducted in SAS 9.4 using a One-Way ANalysis Of Variance (ANOVA) with treatment (planting time DAA) as the independent variable and seedling counts (live and dead, 5 and 10 DAP) as dependent variables. Means were separated at α=0.05 using Tukey’s HSD test.

➢ Tray (replicate) 6 appeared to be an outlier with high mortality in the control and other treatments and was dropped from the analysis.

Results

➢ There was no difference in counts of living plants at 5 Days After Planting (DAP) (Fig. 2.A). According to the overall model, there were differences in the number of dead plants at 5 DAP (P=0.05), but Tukey’s HSD comparison did not show significant comparisons at α = 0.05 (Fig. 2.B).

➢ There was no difference in counts of living plants at 10 DAP (Fig. 2.C). There were differences in the number of dead plants at 10 DAP. The 0 DAA planting date had the highest mortality but was not significantly different than 3 DAA or the control (Fig. 2.D).

Conclusions and Implications

➢ There was no evidence that glyphosate affected germination of the ‘Jinma’ cultivar of hemp seed. However, differences were observed in the count of dead plants at 5 DAP. Results at 5 and 10 DAP did indicate that there could be an effect on seedling survival. However, further research is needed with an increased sample size to determine the cause of mortality after planting. Variable germination and mortality in the control treatment suggest that findings should be cautiously interpreted.

➢ Mortality may be associated with other environmental variables. Future studies should be conducted in a growth chamber where variations in watering schedule and amounts, temperature, and lighting could be avoided.

➢ While results are not conclusive, this study suggests that cautious hemp growers may need to wait 6 days after glyphosate application to plant a crop. These results can be added to the knowledge of best management practices for hemp production.

Literature Cited


Thank you to the McNair Scholars Program for funding.
Adverse Childhood Experiences, School Bullying Retrospection & the Impact on Resilience in Adulthood
Raisa Fountain & Mary Louise Cashel, Ph.D.
School of Psychological & Behavioral Sciences, Southern Illinois University Carbondale

Background

- An individual’s ability to recover adaptively from adversity is vital to their ability to navigate adulthood effectively and is referred to as resilience.
- Adverse childhood experiences (ACEs) have been repeatedly documented to have substantial effects on individual resilience scores in adulthood.
- Children who were involved in bullying or adverse childhood experiences are also significantly more likely to be disengaged from school (Baiden et al., 2020). Children who are disengaged from school are significantly more likely to drop out of school and experience substantial behavioral problems (Henry et al., 2011). Individuals who have experienced frequent bullying are at a greater risk of experiencing suicidality, diagnosis of depression, anxiety disorders, alcohol dependence, psychological distress, and decreased general health, cognitive functioning, socioeconomic status, social relationships, and general well-being for nearly four decades (Takizawa et al., 2014).
- There is a gap in research on the way ACEs and bullying may affect and compound each of their effects on resilience in adulthood. The purpose of this study was to examine the effects of ACEs and retrospective reports of bullying on resilience with a sample of 350 adults under age 40 who were registered MTurk workers in the U.S. selected by CloudResearch.

Hypotheses

- H1: Adverse childhood experiences and bullying victimization will result in lower resilience.
- H2: When bullying and ACEs cooccur, the effect on resilience will be exacerbated.

Methods

Qualtrics Online Survey
ACES-10 Questionnaire:
- 10-item questionnaire asking about specific childhood experiences (see chart 1).
Forms of Bullying (FBS) (Victimization and Perpetration) 10 item likert scales designed to measure victimization and participation in bullying
Connor-Davidson Resilience Scale 25 (CD-RISC25) 25 item likert scale designed to measure resilience levels

DEMOGRAPHICS N=255

<table>
<thead>
<tr>
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<th>Race/Ethnicity</th>
<th>Age</th>
<th>Income Median</th>
<th>Government Assistance</th>
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<tr>
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<td>32.19</td>
<td>$55,000</td>
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<tr>
<td>Male</td>
<td>49.4%</td>
<td>33.22</td>
<td>$55,999</td>
<td>Yes – 21.2% No – 78.8%</td>
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<tr>
<td>Other</td>
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<td>31.73</td>
<td>$55,000</td>
<td>Yes – 21.2% No – 78.8%</td>
</tr>
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</table>

Results

Table 1. Total ACEs

<table>
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<th>Level</th>
<th>Frequency</th>
<th>Percentage</th>
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<tbody>
<tr>
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<td>26.3</td>
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<td>9</td>
<td>1</td>
<td>0.4</td>
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<td>4</td>
<td>1.6</td>
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</table>

Table 2. Bullying Victimization

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<tr>
<th>Period</th>
<th>Frequency</th>
<th>Percent</th>
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</thead>
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<tr>
<td>Elementary</td>
<td>47</td>
<td>18.4</td>
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<tr>
<td>Middle</td>
<td>95</td>
<td>37.3</td>
</tr>
<tr>
<td>High</td>
<td>36</td>
<td>14.1</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>179</td>
<td>70.2</td>
</tr>
</tbody>
</table>


| FBS-V Total | 3.35 | 1.639 | .171 | 2.047 | 0.042 |
| ACEs Total  | -0.63 | 0.586 | -0.09 | -1.075 | 0.284 |

Discussion & Conclusions

- The results of this study were somewhat surprising and stand in contrast to prior research. Our sample reported unusual frequencies of adverse childhood experiences (mo 2.5255) and bullying victimization (70.1%), that was nearly twice that of averages in prior studies. Only 26% of our participants reported zero ACEs, whereas most other studies examining the general population arrive at percentages closer to 46%-52% (Bethell et al., 2014). In other samples around one third or lower of the population reports involvement in bullying (Baiden et al., 2020). Additionally, our mean score for resilience was 63.53, which is about 17 points lower than the average scores reported for this measure (80.4) and in the lowest quartile (Connor & Davidson, 2003). It should be noted that the COVID-19 pandemic may have had an impact on perceived resilience.
- Contrary to expectations, reported experiences of bullying victimization were positively related to reported resilience, whereas the reported experience of childhood adverse experiences demonstrated no significant relationship with resilience scores. These results are surprising and may be an artifact of using an MTurk sample. MTurk workers may be less representative of other community samples than previously reported in the research. However, the positive relationship observed between scores for bullying and resilience are somewhat consistent with observations made by Mash & Barkley (2014), who noted that overcoming mild to moderate adversity facilitates the development of resilience among youth.
- The principal limitations for this study were the cross-sectional (as opposed to longitudinal) design, convenience sample, and web-based survey administration.
- Future studies will need to replicate these findings and ideally incorporate other samples of community adults and youth. Future studies ideally will examine other intervening variables that may play role in the process.

References


Acknowledgements

I would like to thank Dr. Cashel, Rhetta Seymour, the McNair staff and others for the support, guidance and facilitation of this project.
Impact of student presence on space-use of SIU white-tailed deer
Tiana C. Daniels, Michael E. Egan, Nicole T. Gorman, Dr. Guillaume Bastille-Rousseau
Cooperative Wildlife Research Laboratory, Department of Zoology, Southern Illinois University

### Introduction
- White-tailed deer are a part of the natural fauna of Carbondale and easily spotted on SIU’s campus and around town.
- The goal of the overall project is to evaluate how deer on SIU’s campus may change their behavior as the student population on campus fluctuates.
- This preliminary project evaluated characteristics of deer hotspots during the summer when campus population is smaller.

### Methodology
- Deer were captured using clover traps and protocols approved by IACUC.
- GPS collars were placed on 4 males and 3 females.
- GPS collars transmit deer location every 30 minutes for females and 60 minutes for males.
- Using a "geographic information system (GIS)", coordinates of the five main hotspots were extracted.
- Each hotspot was paired with a random point within a 500m buffer.
- For each hotspot and random point, lateral cover and vegetation (shrubs, forbs, and grass) were evaluated.

### Results
- Hotspots of deer were distributed across campus (Fig. 1)
- Hotspots differed based on the cover and vegetation offered (Fig. 2)
- No patterns emerged from comparing hotspot attributes to random points (Fig. 2)

### Conclusion
- Hotspots were either used for foraging (hotspots with greater amount of vegetation) or used for resting or thermoregulation (hotspots with more cover).
- Future analyses of hotspots will evaluate if the properties of the hotspots will change as student numbers increase.

### Acknowledgements
We would like to thank the SIU Foundation for supporting the collaring of the deer used in this study. We would like to thank the McNair Scholars Program for assistance with funding for this project.

### References
Purpose: Does Illinois High Schools properly prepare their students for college? Which region of Illinois does the best college preparation for high school students?

Methodology
- Data collected from Illinois School Report Card database
- Randomly selected 60 high schools
- Took the mean of all data collected

Factors

EARLY COLLEGE COURSEWORK
The total number of students taking early college courses in 2018 was 168,043. About 27.3% of all students in Illinois public schools are enrolled in early college coursework. (Illinois Report Card).

In grade 12, about 55,838 students take one or more AP courses (Illinois Report Card).

In grade 12, about 33,555 students take one or more dual credit courses (Illinois Report Card).

COUNSELING
Counselors in predominately poor schools with large numbers of racial minorities cannot provide adequate guidance (Hinton & Adams, 2006). When counselor to student ratios are high, counselors have limited time to advise each student.

McDonough (1997) also noted the extent to which counselors helped students in the college preparation process varied by the organizational capacity of schools. School size, resources, and competing priorities overwhelmed counselors in less affluent schools.

TESTING
The average Scholastic Assessment Test (SAT) score for all students in Illinois in 2018 for the English Language Arts was 505.7, which falls in the approaching standards category. (Illinois Report Card)

The average Scholastic Assessment Test score for all students in Illinois in 2018 for the Math section was 501.4, which is the approaching standards category. (Illinois Report Card)

Results

Discussion

• Early College Coursework, Teacher to student ratio, and SAT Averages are link to Postsecondary Enrollment and College Remediation
• Southern Illinois and Central Illinois had similar pairings across the graphs.
• Northern Illinois has the largest number of students enrolled in early college coursework. Considering majority of the schools collected were in Cook county there would be more students enrolled. However, it still falls behind on all other measures.
• Southern Illinois Region is meeting the standards for student to teacher ratio, SAT average scores, college remediation, and Postsecondary enrollment.

Future Implications

• This data can illustrate what type of students are likely to be accepted by colleges and universities.
• This can help institutions properly serve their students' needs including offering extra support services.
• Consider the number of students graduating from four-year universities.
• Consider having more counselors and more funding per pupil.
• Look into the reasons why students' test scores are just approaching standards in the state of Illinois.
• There should be a study on what type of college coursework is more beneficial for college admissions and persistence to reduce the need for remediation courses.

References


This project was supported by the SIU McNair Scholars Program.
Abstract

According to social disorganization theory (Shaw and McKay 1969), the physical neighborhood or environment can contribute to child delinquency. The purpose of this study was to create a rapid systematic review of published work from 2015-2019 that examine three environmental factors that have an impact on child delinquency. The three factors observed were peer delinquency, educational attainment, and socioeconomic factors. To help this study, journal articles were critically analyzed to learn the impact the factors have on child delinquency. Suggestions are made to improve interventions used to reduce delinquent behaviors.

Key Concepts

- Social Disorganization, is a state of society characterized by the breakdown of effective social control resulting in a lack of functional integration between groups, conflicting social attitudes and personal maladjustment

- Child delinquency, a conduct by juvenile characterized by antisocial behavior that is beyond parental control and therefore subject to legal action

- Socioeconomic factors, involving a combination of social and economic factors

- Peer delinquency the power or influence a social group exerts on an individual or individuals

- Social Control theory, the attachment or bonding of people with conventional people such as friends, family members or loved ones, institutions, activities and beliefs that make people conform to society norms.

Methodology

- Social Disorganization was identified and related to child delinquency.
- Identified environmental factors impacting youth, age 14-18.
- Systematically reviewed journal articles published between the years of 2015-2019.

Acknowledgements

I would like to thank the McNair Scholars Program of Southern Illinois University, Carbondale and the Department of Criminology and Criminal Justice. I would also like to thank Jorden Thomas for her help and support.

The Impact of the Environment on Child Delinquency

Destanee Williams and Dr. Julie A. Hibdon
Department of Criminology and Criminal Justice

Significance of environmental factors in child delinquency based on a rapid review of published work.

Peer Delinquency

- Low levels of self control, parental attachment, and school commitment are predicted to influence the general tendency to engage in delinquent conduct but not have a crime-specific effect [8].
- Adolescents without identity commitments, or without motivation to explore new commitments, are thought to be more likely to conform to peer influences due to lack of strong beliefs in their own [2].

Educational Attainment

- United States juvenile offenders suggest there is not a lack of interest in pursuing education among this population, but rather a disconnection with educational systems when education providers are perceived not to care about students’ progress [6].
- Parents that are more likely to obtain education are inherently more likely to raise children in ways that are less conducive to crime [3].

Socioeconomic Factors

- There is considerable evidence to demonstrate that low socioeconomic status is associated with negative adolescent outcome [5].
- Having a low socioeconomic status may accumulate overtime to increase the likelihood of adolescents delinquent behavior and future criminality [5].

Future Study

- Focus on demographics (location, race, and gender)
- Expand database utilization
- Develop a survey

References

1 | Saminsky
3 | Chaffin & Deza
4 | Floyd
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13 | youth.gov
Introduction

The naked mole-rat (Heterocephalus glaber) is a burrowing rodent native to hot, dry regions of Eastern Africa, such as Somalia, Central Ethiopia, and parts of Northern and Eastern Kenya.

They depend almost solely on their tactile hairs and incisors, to which their tactile hairs are at their highest concentration at the muzzle and tail. A study conducted by Catania and Remple in 2002 showed that 31% of the primary somatosensory cortex was represented by the incisors (figure 2). Due to the animal’s poor visual acuity as well as its poor auditory abilities (Jarvis & Sherman, 2005), the somatosensory cortex - containing the dominant tactile sensory inputs - is able to occupy expanded regions of the brain, including areas that are generally devoted to vision. The same study found that S1 was also larger in size compared to other mammalian species, and was displaced more caudally.

Methods

| Day 1 (June 24th) | Brain extraction |
| Day 2 (June 25th) | Brains placed in Cox solution |
| Day 3 (June 26th) | Replace brains in new Cox solution |
| Day 13 (July 1st) | Tissue protection |
| Day 14 (July 2nd) | Tissue protection |
| Day 21 (July 11th) | Brain sectioning |
| Day 23 (July 13th) | Tissue development |
| Day 25 (July 17th–19th) | Analysis |

Subjects

- Two adult naked mole rats (approx. 60g in weight) were used for this study. All procedures were approved by the SIU IACUC.

Brain Extraction

- Subject brains were extracted for impregnation following euthanization of the animals.

Impregnation

- Halved brain samples were immersed in Golgi-Cox impregnation solution, then tissue protectant for 7 days each.

Sectioning

- Brain samples were sectioned into 100-200 µm thick slices using a vibratome.

Staining and Mounting

- Sectioned samples were developed and counterstained using 1% cresyl violet and 5% sodium thiosulfate.
- After staining, samples were mounted, cover-slipped, and stored until analysis.

Analyzing the Primary Somatosensory Cortex

- Imaging of S1 with Leica 4500 light microscope.
- Image processing with Adobe Photoshop.
- Qualitative & quantitative analysis of dendritic arborizations and spines with Fiji software.

Figure 3: Timeline of the Experiment. Highlighted events indicate project step completion. Methods obtained and adjusted as needed from Zaqout & Kaindl, 2016.

Figure 4: Example of Golgi-Cox Staining on Rat Brain (Maiti et al., 2015).

Conclusion

- Due to the experimental constraints regarding time limitation from the extensive process in congruence with supply delay, this study remains of interest.
- Our results will consist of both qualitative and quantitative forms of analysis on the neurons in S1:
  - Neuron morphology
  - Cell soma area (µm²) and volume (µm³)
  - Dendritic length (µm)
  - Dendritic spine density (spines/µm)
  - Sholl analysis
- Future research is important to find suggestions regarding the importance of neuroanatomical aspects:
  - What significance do the different morphologies of neurons bring about?
  - How does neuroplasticity narrate the physical implications of phantom pain?

Future Directions

- This study will be continued throughout the Spring semester. The brain sample analyzed in the current project will be used as a control. A tooth extraction on the lower incisor will be administered and a Golgi-Nissl analysis will be done with the subject to understand the dynamics of neuroplasticity following tooth loss.
- Concepts that are obtained from this research can ultimately be applied to medicine, impacting the way neuroplasticity in the pathology of neurodegenerative diseases such as Alzheimer’s disease, Amyotrophic Lateral Sclerosis, or phantom pain is understood.

References


Acknowledgements

This research was supported, in part, by the McNair Scholar’s Program. A special thank you to Dr. Diana Sarko and Dr. Joseph Cheatwood for the use of their laboratories, alongside the lab staff.
Organic-Inorganic Titanium Halide Perovskites for Photovoltaic Application

Christian Rose; Dr. Kanchan Mondal
Mechanical Engineering and Energy Processes

Introduction

Currently, the most efficient perovskite solar cells (PSCs) rival the efficiency of the market-dominating silicon-based solar cells. Perovskite solar panels are desirable because they are much cheaper to produce and are more versatile than their silicon counterpart. PSCs are very thin and can be produced as a flexible film through roll to roll processing. The current downfalls of these solar cells are their lack of stability and the toxicity of the highest performing lead-based cells. To this point, only two other universities in the country have experimented with titanium-based PSCs. Researchers led by Dr. Ming-Gang Ju and PhD candidate Min Chen from the Universities of Nebraska and Brown, respectively, have predicted the absorption characteristics of a family of titanium-halide perovskites in an effort to produce efficiencies comparable to their silicon counterpart. PSCs are very thin and can be fabricated to completely inorganic cells that achieved an efficiency of 3.3%.

Methodology

Perovskite Synthesis

- FAI(s) + PbI₂(s) → FAPbI₃ (aq)
- 2FAI(s) + TiI₄(s) → FA₂TiI₆ (aq)
- 2FAI(s) + TiCl₄(l) → FA₂TiCl₄ (aq)
- FA₂TiI₆ & FA₂TiCl₄

Solution Experimentation

- Heated at Several Temperatures (90-140°C)
- Exposed for Various Durations (20-60 minutes)
- Submerged in 60°C Bath for 24 Hours

Electron Transport Layer

- Titanium Isopropoxide Solution Prepared
- Spin-Coating Techniques Investigated

Characterization

- X-Ray Diffraction (XRD)
- UV-Vis Spectroscopy (UV-Vis)
- Scanning Electron Microscopy (SEM)

Discussion and Conclusions

- Titanium Halide Perovskites Formed
- FA₂TiI₆ & FA₂TiCl₄
- Electron Transport Layer Synthesized
- Titanium Isopropoxide Solution
- X-Ray Diffraction Performed
- Crystal Structure of FA₂TiI₆ Observed
- UV-Vis Absorption Spectra Obtained
- Inconsistent Results
- SEM Images Gathered
- Surfaces of Perovskites and TiO₂ Observed
- Fabrication Techniques Explored
- Trial and Error for Spin-Coating Techniques

Future Outlook

- Further investigation of Perovskite Crystal Structure
- Endeavor Software for Modelling
- Conversion of UV-Vis Results to Tauc Plot
- Bandgap Calculation
- Hole Transport Membrane Synthesis
- Materials Prepared
- Solar Cell Fabrication
- Current Voltage Testing
- Short Circuit Current & Open Circuit Voltage
- Fill Factor
- Photoelectric Conversion Efficiency

References


Acknowledgements

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Toward Developing Immunoassays Using the HE4 Biomarker to Improve the Early Detection of Epithelial Ovarian Cancer

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Carbondale, IL 62901

Introduction

Despite only accounting for 3% of all new cancer cases, epithelial ovarian cancer (EOC) is the fifth most common cause of death in women [1]. EOC is essentially asymptomatic in its early stages, therefore, its diagnosis typically occurs during stage III-IV. This late-stage diagnosis causes a 5-year survival rate of only 17%-29% due to the futility of treatments against advanced malignancy [1]. If, however, detection occurs early, during a mild, localized stage, the 5-year survival rate increases to 90% [1].

A promising technique to improve early detection of EOC is the recent development of invasive tests for the natural biomarkers, including cancer antigen 125 (CA125) and human epididymis protein 4 (HE4), present in the human blood plasma. CA125 has been FDA-approved for clinical use for many years. However, elevations in HE4 serum levels have been observed in patients with malignant EOC at both localized and metastasized stages. To that present in the human blood plasma.

CA125 demonstrates a much higher specificity for EOC, with a magnetic particle for purification purposes, and the HE4 antigen rendering no false-positive results. This study utilized immunoassay techniques to measure concentrations of HE4 in a synthetic serum in an effort to innovate a more accurate early detection method. The antibody in our immunoassay was modified with a magnetic particle for purification purposes, and the HE4 antigen was modified with a SiO2 label responsible for creating a unique signal, which will be detected using laser-induced breakdown spectroscopy (LIBS). Successful bioconjugation, required for the immunoassay, was confirmed using ultraviolet-visible spectroscopy (UV-VIS).

Methodology

LIBS Experimental Setup

Bioconjugation

Fig. 1. (a) Schematic of automated LIBS experiment using EKSPLA picosecond (duration 30ps) and high-resolution StellarNet spectrograph (b) mechanism of laser ablation and formation of crater. Ablation pattern is controlled XY motorized stage.

1.5 μm diameter of Fe3O4 particles, pre-modified with protein-A; (ii) 1 μm diameter of SiO2, pre-modified with an amine; (iii) conjugation of pre-modified magnetic particles with anti-HE4 monoclonal antibodies and diluted with phosphate-buffered solution (PBS); (iv) washout unbound SiO2 particles with applied magnet.

Results

LIBS Calibration Curve for SiO2

Fig. 3. Average (150 laser pulse) LIBS spectra from 225 nm to 330 nm of a mixture of SiO2 and Fe3O4 by made ablating the sample with 20 ml, showing the specific reference peaks of Si and Fe, respectively.

Fig. 4. LIBS emission spectrum for each varied concentration of SiO2 mixed with a constant amount (50 μg) of Fe3O4. (a) emission of Si I (288.1 nm) (b) emission of Fe I 238.2 nm

UV-VIS Spectra for Antibody Absorbance

Fig. 6. The UV-VIS spectra above shows the absorbance readings measured at 280 nm for set concentrations of protein A-modified Fe3O4 magnetic particles coupled to the anti-HE4 antibody. The nanodrop was set such that 1 absorbance = 1 mg/mL. After 3 hours, the coupling efficiency was estimated approximately ~48%.

Fig. 7. The LIBS spectra shows the SiO2 peak from the developed immunoassay. Emission of Si may contribute from unbounded SiO2; optimization of assay is needed.

Conclusion

Although we created a strong SiO2 calibration curve, the LIBS spectra of the Fe reference peak were supposed to remain constant, showing a consistent concentration of Fe3O4. This error could be attributed to the instrument itself, which has a 5%-10% error. Additionally, the first step of the bioconjugation process of the immunoassay was achieved, and successful conjugation efficiency was shown using UV-VIS. Additionally, preliminary results show sensitive detection of HE4 using bioconjugation with LIBS technique.

Future Directions

The elemental concentration, down to the part-per-million level, of the successful immunoassays can be determined using LIBS. To interpret the final data, we plan to plot the intensities of Si-specific spectral emission lines for each respective HE4 concentration. Developing immunoassay with LIBS to detect multiple biomarkers (CA125 & HE4) simultaneously to improve sensitivity and specificity

Finally, after successfully measuring lowing concentrations of serum HE4 in a synthetic sample, we plan to use our novel detection method in human blood samples to determine HE4 levels from a natural serum.

Acknowledgements

I would like to thank Rhetta Seymour, Dr. Laxmi Sagwan-Barkdoll, and the other McNair staff members for their guidance through the McNair Summer Research Institute.

References

How Accurate are Label Claims in CBD Products?

Jacob Janicki, Laxmi Sagwan-Barkdoll and Aldwin Anterola
Southern Illinois University Department of Plant Biology

Results

The purpose of this study was to measure the amount of CBD in four randomly selected CBD products available in the Southern Illinois area to determine the accuracy of the CBD content in these products as displayed in their labels.

Methodology

Samples: Four different brands of “CBD oil” were purchased from local retail shops, and stored at room temperature.

Extraction: Each sample of CBD oil was extracted using the same extraction method, as follows:

• 1 mL of sample was extracted in 9 mL of 1-pentanol and was vortexed for 15 seconds.
• 1 mL of extract was diluted in 9 mL of methanol bringing the extract to a dilution factor of 100. Mixture was vortexed for 15 seconds.
• 0.5 mL of diluted extract was diluted further with methanol to a final volume of 10.0 mL, and vortexed for 15 seconds, bringing the mixture to a final dilution factor of 2000.
• Diluted extract was then filtered through a 0.22 μm filter and 1 mL of final filtered diluted solution was transferred to a vial for HPLC analysis.

HPLC Analysis:

• 0.5 mL of diluted extract was diluted further with methanol to a final volume of 10.0 mL, and vortexed for 15 seconds.
• 1 mL of extract was diluted in 9 mL of methanol bringing the mixture to a final dilution factor of 2000.

Discussion

• Samples 1 and 2 had lower amounts of CBD than what were calculated from their labels, although Sample 2 did not explicitly state any amount of CBD but only the amount of hemp extract.
• Samples 3 and 4 had higher amounts of CBD than what were calculated from their labels, although Sample 3 is within the range of our experimental standard deviation.
• Sample 3 included a value for the amount of hemp extract besides the amount of CBD, from which amount of CBD in hemp extract can be calculated (81%). This would be higher for Sample 2 which would then have 85% CBD in hemp extract.
• The average cost of CBD oil is around $30 for a 30 ml bottle. Sample 4 is priced as such, but contains the least CBD per ml. Sample 3 is the most economical, which we purchased for $31 for a 60 ml bottle, and contains the most CBD per ml.
• Methanol evaporates very quickly and may have caused some variation between extractions. It is also worth noting that methanol reacts with olive oil based solutions such as Sample 1 and 2. When methanol is mixed with olive oil the solution turns very turbid. More research would be needed to determine if this has an effect on the variability of results from the extractions.

Conclusions

• The labeling of CBD oil products is consistent from brand to brand, which may be due to varying regulations in each state.
• The actual amount of CBD in different CBD oils may be higher or lower than what is claimed in the label by about 15% in most cases. At least 1 product is accurately labeled within 5% error.
• While prices of CBD oils vary by a wide range, the prices do not necessarily reflect the amount of CBD in the product.
• Pentanol extraction and dilution with methanol for HPLC analysis is well suited for quantifying CBD in oil, with acceptable relative standard deviations of 6-12%.

References


Regulations of Commercial Dog Food Across America: A Review

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Abstract
The evaluation of foods used for the nutrition of domestic animals is a matter of great importance. A major function of feed regulation is to safeguard the health of animals, and a critical component of that function is to ensure that animal feed and feed ingredients are appropriately and safely used as provided by the product label. Prepared foods for dogs are no exception, and the pet food industry aims to provide safe, palatable, digestible, and nutritionally balanced foods for pet animals at prices affordable by the human owner. Although pet food falls under regulations, who enforce these regulations, and why are there so many recalls happening in the United States? The objective of this project was to investigate the mislabeling, regulatory guidelines, and the nutritional aspects of commercial dog foods. We found that the FDA controls the majority of the regulations with the help of the State Department of Agriculture. We also observed through available published research that mislabeling of products and false claims on pet food are the leading causes of pet food recalls. In a future direction to this research, a questionnaire will be sent out to Veterinarian offices of State Department of Agriculture for each state to assess the similarities and dissimilarities between their current regulations and guidelines for commercial dog foods.

Findings
Recognizing Recalls
Dog Food Recalls Within the Past Five Years

Regulations

Pet food labeling is regulated at two levels:
- Require proper identification of the product, net quantity statement, name and place of business of the manufacturer or distributor, and proper listing of all the ingredients in the product in order from most to least based on weight
- Reviews specific claims on pet food (e.g. low magnesium, joint control, weight control, etc)

Labeling

Mislabeling
- Mislabeling of dog feed has become a widespread problem. This arises conflict because it shows that the feed is not properly labeled which could cause issues with toxicological safety, palatability, and nutritional suitability.
- Many studies have been conducted on mislabeling of feeds. In a recent study that analyzed 40 products, while only 10 of them were properly labeled. 13 out of 14 brands tested presented at least one mislabeled product. 3 out of 4 feeds were contaminated with 1 of 7 animal species not listed on the label. The most frequently contaminants identified were pork, chicken, and turkey.
- Mislabeling causes many health issues and can even result in death of the animal. Contaminants can either have too much, too little, a nonexistence of a nutrient, or a additive of an ingredient not listed.

Future Direction
- The next step is forming a questionnaire. The questions that will be formed will be based on the information needed to conduct the missing pieces of regulations and understand why there are so many mislabeling and recalls. This questionnaire will be sent out to all 50 states. Each state will be sent to the Department of Agriculture office as well as the State’s Veterinary office.
- After receiving the questionnaire back, results will be compiled, and further investigation and research will be conducted with the agencies.
- Below is an example that is portrayed on the questionnaire.

Question #6: How many products were non-compliant with labeling requirements in 2018?

Please provide a list of all products/companies that were identified as non-compliant in 2018.

Notes:

Acknowledgements
- I would like to thank the Ronald E. McNair Scholars Program for allowing me the resources and opportunity to conduct research.
- Dr. Erin Perry for mentoring me and allowing me the opportunity to learn and work within the Agriculture Department at Southern Illinois University.
- Dr. Lakshmi Sagwan for providing guidance and direction during the McNair Summer Research Institute.

References
Drone Based Monitoring of Harmful Algal Blooms: Preliminary Data Collection and Procedural Understanding

Luis Prado, Dr. Ruopu Li
Department of Geography and Environmental Resources

Abstract

Harmful Algal Blooms (HABs) contribute negatively to environmental and human health. Corresponding with rapid changes in global climate and continual trends of anthropogenic waterway pollution, humanity faces HABs as an intensifying threat (Gilbert, 2013; Moore et al. 2008). Key to combat this growing concern is the ability to study and monitor the bodies of water in which communities intend to protect. An increasingly explored solution is the utilization of Unmanned Aerial Vehicles (UAVs) and the building of relationships between remotely sensed data and physical characteristics of HABs. This study focused on a possible preliminary methodology to be applied to such research, including processes and techniques for water sample collection, image capture, and water sample analysis, while posing hypothetical approaches for spectral analysis and future model building. Results illustrated a positive outlook on the employment of the explored methodology to future studies with success in the posed systems of data collection and the potential for further analysis and application.

Key Concepts

- Harmful Algal Blooms (HABs)
- Water Quality
- Remote Sensing
- Unmanned Aerial Vehicles (UAVs)

Results

<table>
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<tr>
<th>Sample no.</th>
<th>Volume of sample/mL</th>
<th>Concentration of algae, g/L</th>
<th>Weight of wet samples for Chl A</th>
<th>Chl A concentration (mg/L extract)</th>
<th>Chl A concentration (mg/L sample)</th>
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</table>

Conclusion and Discussion

Solidified Procedures for Productive Data Collection
Chl-a Detection
Theoretical Understanding of Image Analysis and Model Construction
Established Groundwork for Further Application

Future Endeavors

Extended Timeline and Funding through REACH Grant

Acknowledgements

I am very appreciative of Dr. Ruopu Li as my mentor and advisor for this project. I am grateful for the network of Masters and Ph.D. students Dr. Li and Dr. Liu have built around me and my endeavors, including Peerzada Madany, Sourav Bhadra, Dr. Chunjie Xia, Di Wu, and Lindsey McKinzie. A special thank you to Rhett Seymour for her guidance and support, and all of the wonderful work of the McNair Scholars staff, Jordan Thomas, Dr. Laxmi Sagwan-Barkdoll, and Francois Gatimu. Thank you for showing students what they are capable of accomplishing.

Work Cited

The History of African Americans in Organized Medicine and Frontier Medicine, 1850 - 1914

Jawau Valentine & Dr. Pamela Smoot
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Abstract
It was not until African American historians such as Kenneth Hamilton and Neil Painter, began to publish books and articles did history include African American migrants who settled in the West. They contend that they were an integral part of its settlement and its character despite the numerous challenges they encountered. Yet, African Americans managed to establish all-black towns complete with institutions and professionals of their own race including educators, journalists, realtors, architects, and nurses. However, there was no mention of African American physicians. This study explores the lives of these frontier physicians with emphasis on Dr. George A. Tann, the transition of medicine from frontier to organized medicine, and the struggles of African Americans to obtain formal training in medicine.

Objectives
The objective of this research project is to unearth the narratives and history of African Americans on the Western Frontier and in medicine through the analysis of primary and secondary documents.

Key Terms
Frontier Medicine: Medicine administered by physicians who had little or no professional medical training and relied heavily on remedies derived from Native American medicine, available flora, and other experiences.

Professional Medicine: Medicine practiced by individuals who had obtained a Medical Degree from a recognized Medical School.

Pioneers in Medicine

Dr. John McCune Smith
The earliest an African American had entered the medical profession was in 1837 when James McCune Smith obtained his medical degree at the University of Glasgow in Scotland.

Dr. David Jones Peck
The first African American man to obtain a medical degree from a recognized university in the United States was David Jones Peck from Rush University in 1846. While at Rush, Peck’s education career was in jeopardy when several of his white classmates complained about his race and enrollment in the program. The president, Dr. Daniel Brainard, left the decision to dismiss Peck from medical school to his classmates with the majority voting in favor of Peck.

Dr. Rebecca Lee Crumpler
The first African American woman to obtain a medical degree was Rebecca Lee Crumpler 18 years later at the New England Female Medical College (NEFMC) in 1864. Her experience in medical school was much different than those of African American males.

Organized and Frontier Medicine

Martin Delaney
Amidst the achievements of early African American medical professionals, many of them struggled with racism and discrimination including Martin Delaney. He sought a medical degree from Harvard University Medical School in 1850. His white classmates successfully petitioned the Medical School faculty for his expulsion. Delany’s dismissal came despite his outstanding recommendations from former employers, mentors, and community leaders.

Dr. George A. Tann
During Reconstruction, thousands of African Americans migrated west escaping mob violence in the south. Once settled, there was a need for physicians of their own race. Dr. George A. Tann would answer the call.

He was a successful frontier physician in Northern Oklahoma and Southern Kansas from 1870 to 1902. His story was brought to prominence through Laura Ingalls Wilder’s ‘Little House on the Prairie’ series. In the year 1870, Dr. Tann went to the Ingalls’ house and cured Laura and her sister of malaria. As the frontier population increased came the practice of organized medicine. Dr. Tann possessed no formal medical degree and was contacted by the Northern Judicial District of the Cherokee Nation. It issued a list of individuals practicing medicine within its borders without valid medical degrees mandating that they cease practicing medicine. Dr. Tann’s extensive medical career ended in 1902.

Blacks in Medicine: Future Research
African Americans sought an education in medicine and were often denied, but not discouraged from achieving their dream. After the era of their struggles, came the subsequent establishment of seven African American medical schools between 1868-1904.

Dr. Henry Fitzbutler
• an exceptional physician and educator.
  He lobbied Kentucky’s legislature until it granted approval of the first black-owned medical college in Louisville.
  Founded in 1888, the Louisville National Medical College’s purpose was to train African American doctors.
  Approximately 150 doctors graduated from the college before it encountered financial hardship and closed in 1907.

Flexner Report
• The medical schools for African Americans were shattered by Flexner Report whose author, Dr. Abraham Flexner, called for a more stringent curriculum among medical schools and the rigorous training of its future doctors.
  He successfully recommended the closing of those that were substandard.

After 1923, only two black medical colleges remained from the previous nine, Howard University and Meharry Medical Colleges. It would be worthwhile to examine the decline of black medical colleges with more voracity in the future, to explore the lives of other African Americans frontier physicians, and their possible acclimation into the era of organized medicine. It would be of great consequence to also investigate the role of women in medical care as nurses, midwives, and most importantly, as physicians. Looking to the future, the history of African Americans in medicine is largely a wellspring of information providing insight to experiences of African Americans since the eighteenth century. More research should be conducted in order to delve deeper into this topic and uncover the stories of more African American frontier physicians, because it is likely that their were others.

References

Letter to Harvard Medical School Faculty from Medical Class, Harvard University Medical Archives, Harvard Medical School, Dear [Name], Petition of Attendance of Colored Students 1880-1883, December 10, 1890


Jawaun Valentine & Dr. Pamela Smoot

Acknowledgements
I would like to thank my mentor Dr. Pamela A. Smoot for her guidance, the McNair scholars program for providing such a wonderful opportunity, and the COLA Dean’s office providing and work space. This research would not have been possible without SIU Reference Librarians Matt Borowicz and Philip Hozuce, the Harvard University medical school Archives, and the Historical Branches and State Archives of Colorado, Kansas, Nebraska, and Oklahoma and their efforts to assist me in with this project. I would like to thank the McNair scholars program for providing such a wonderful opportunity, and the COLA Dean’s office providing and work space. This research would not have been possible without SIU Reference Librarians Matt Borowicz and Philip Hozuce, the Harvard University medical school Archives, and the Historical Branches and State Archives of Colorado, Kansas, Nebraska, and Oklahoma and their efforts to assist me in with this project. I would like to thank Dr. Pamela A. Smoot for her guidance, the McNair scholars program for providing such a wonderful opportunity, and the COLA Dean’s office providing and work space. This research would not have been possible without SIU Reference Librarians Matt Borowicz and Philip Hozuce, the Harvard University medical school Archives, and the Historical Branches and State Archives of Colorado, Kansas, Nebraska, and Oklahoma and their efforts to assist me in with this project.
Fabrication of a 3D Biodegradable Polymer for Bone Tissue Engineering

Andres Womac and Dr. Peter Filip
Department of Mechanical Engineering and Energy Processes

Introduction

Biodegradable Polymers are gaining more attention for their uses in bone tissue engineering, maxillofacial orthopedic surgeries for broken and diseased bones, as well as drug delivery carriers. Poly(lactic-co-glycolic acid) (PLGA) is one of the most popular FDA approved biodegradable polymers because of its biocompatibility, osteoconductivity, and favorable degradation rate. As of recently there has been growing research in using 3D scaffolds as a way to mimic the extracellular matrix (ECM) allowing the scaffolds to be used as a substrate for cell proliferation and cell differentiation. There has also been growing interest using PLGA as a replacement for traditional titanium plates in screws that are used in many orthopedic surgeries such as internal fixation. There are several drawbacks to using titanium such as increasing the possibility of stress shielding causing the bone to lose density. A secondary surgery is also required to remove the plates and screws. By using PLGA instead of titanium orthopedic surgeons are able to lower the effects of stress shielding by gradually incorporating stress onto the bone as well as eliminating the need for any secondary surgeries.

Methods

| Pour | Place in Freezer Overnight | Finished PLGA Film |
| PLGA + DCM | Glass Petri-Dish |

Figure 1: Protocol for fabrication of thin film PLGA

Protocol for Degradation Assay of thin film PLGA:

Circular disks were created from the fabricated PLGA film and the discs were initially weighed on a Digital Precision Scale and then placed into 15ml Centrifuge Tubes with 3ml of 0.9% NaCl in distilled water. Disks were removed after a day, dried, and re-weighed. The process was repeated every day. Day, time, and weight were recorded in an excel spread sheet.

| Pour until mold is 1/3 full | Place mold in a vacuum chamber until PLGA sets. | Repeat the pouring and vacuuming process until you have a finished PLGA material |
| PLGA + DCM | Teflon Mold |

Figure 2: Protocol for fabrication of 3D PLGA

Objectives

- To fabricate a thin film of PLGA
- Analyze degradation assay
- To fabricate a 3D PLGA material

Results

![Figure 3: Thin film of PLGA](image)

![Figure 4: Degradation Assay](image)

![Figure 5: Optimization of the 3D PLGA. A) Using Solvent Casting Method, B) Using layer-by-layer method with 1g of PLGA, C) Using layer-by-layer method with 2g of PLGA](image)

Conclusions

- Successfully fabricated a thin film of PLGA (Fig.3)
- Degradation assay demonstrated that the fabricated thin film PLGA was biodegradable with 5% total mass loss (Fig. 4)
- Pouring 0.5g of PLGA using Solvent Casting Method caused a hollow structure (Fig. 5A)
- Using a layer-by-layer method with 1g of PLGA generated more thickness but still resulted in a hollow structure (Fig. 5B)
- Using layer-by-layer method with 2g of PLGA resulted in a successfully fabricated 3D PLGA material (Fig. 5C)

Future Directions

- Incorporate Single Walled Carbon Nanotubes to improve mechanical properties of polymer
- Optimize degradation assay
- Perform microhardness testing using the HSV-20 Shimadzu Microhardness Tester on fabricated 3D PLGA

References


Acknowledgements

- Supported, in part by the Illinois Louis Stokes Alliance for Minority Participation. We thank Laxmi Sagwan-Barkdoll, Jason Henry, Ryan Welsh and Karen Renzaglia for assistance on the research.
The History of African Americans in Organized Medicine and Frontier Medicine, 1850 - 1914

Jawaun Valentine & Dr. Pamela Smoot
Southern Illinois University Carbondale, Department of History

Abstract

It was not until African American historians such as Kenneth Hamilton and Neil Painter, began to publish books and articles did history include African American migrants who settled in the West. They contend that they were an integral part of its settlement and its character despite the numerous challenges they encountered. Yet, African Americans managed to establish all-black towns complete with institutions and professionals of their own race including educators, journalists, realtors, architects, and nurses. However, there was no mention of African American physicians. This study explores the lives of these frontier physicians with emphasis on Dr. George A. Tann, the transition of medicine from frontier to organized medicine, and the struggles of African Americans to obtain formal training in medicine.

Objectives

The objective of this research project is to unearth the narratives and history of African Americans on the Western Frontier and in medicine through the analysis of primary and secondary documents.

Key Terms

Frontier Medicine: Medicine administered by physicians who had little or no professional medical training and relied heavily on remedies derived from Native American medicine, available flora, and other experiences.

Professional Medicine: Medicine practiced by individuals who had obtained a Medical Degree from a recognized Medical School.

Pioneers in Medicine

Dr. John McCune Smith
The earliest an African American had entered the medical profession was in 1837 when James McCune Smith obtained his medical degree at the University of Glasgow in Scotland.

Dr. David Jones Peck
The first African American man to obtain a medical degree from a recognized university in the United States was David Jones Peck from Rush University in 1846. While at Rush, Peck’s education career was in jeopardy when several of his white classmates complained about his race and enrollment in the program. The president, Dr. Daniel Brainard, left the decision to dismiss Peck from medical school to his classmates with the majority voting in favor of Peck.

Dr. Rebecca Lee Crumpler
The first African American woman to obtain a medical degree was Rebecca Lee Crumpler 18 years later at the New England Female Medical College (NEFMC) in 1864. Her experience in medical school was much different than those of African American males.

Organized and Frontier Medicine

Martin Delaney

Amidst the achievements of early African American medical professionals, many of them struggled with racism and discrimination including Martin Delaney. He sought a medical degree from Harvard University Medical School in 1850. His white classmates successfully petitioned the Medical School faculty for his expulsion. Delany’s dismissal came despite his outstanding recommendations from former employers, mentors, and community leaders.

Dr. George A. Tann

During Reconstruction, thousands of African Americans migrated west escaping mob violence in the south. Once settled, there was a need for physicians of their own race. Dr. George A. Tann would answer the call.

He was a successful frontier physician in Northern Oklahoma and Southern Kansas from 1870 to 1902. His story was brought to prominence through Laura Ingalls Wilder’s ‘Little House on the Prairie’ series. In the year 1870, Dr. Tann went to the Ingall’s house and cured Laura and her sister of malaria. As the frontier population increased came the practice of organized medicine. Dr. Tann possessed no formal medical degree and was contacted by the Northern Judicial District of the Cherokee Nation. It issued a list of individuals practicing medicine within its borders without valid medical degrees mandating that they cease practicing medicine. Dr. Tann’s extensive medical career ended in 1902.

Black in Medicine: Future Research

African Americans sought an education in medicine and were often denied, but not discouraged from achieving their dream. After the era of their struggles, came the subsequent establishment of seven African American medical schools between 1868-1904.

Dr. Henry Fitzbutler

• an exceptional physician and educator.

He lobbied Kentucky’s legislature until it granted approval of the first black-owned medical college in Louisville. Founded in 1888, the Louisville National Medical College’s purpose was to train African American doctors.

Approximately 150 doctors graduated from the college before it encountered financial hardship and closed in 1907.

Flexner Report

• The medical schools for African Americans were shattered by Flexner Report whose author, Dr. Abraham Flexner, called for a more stringent curriculum among medical schools and the rigorous training of its future doctors.

He successfully recommended the closing of those that were substandard.

After 1923, only two black medical colleges remained from the previous nine, Howard University and Meharry Medical Colleges. It would be worthwhile to examine the decline of black medical colleges with more voracity in the future, to explore the lives of other African Americans frontier physicians, and their possible ascillation into the era of organized medicine. It would be of great consequence to also investigate the role of women in medical care as nurses, midwives, and most importantly, as physicians. Looking to the future, the history of African Americans in medicine is largely a wellspring of information providing insight to experiences of African Americans since the eighteenth century. More research should be conducted in order to delve deeper into this topic and uncover the stories of more African American frontier physicians, because it is likely that their were others.

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Lettier to Harvard Medical School Faculty from Medical Class, Harvard University Medical Archives, Harvard Medical School, Dean’s Files, Petition of Attendance of Colored Students 1850-1853, December 10, 1850


Acknowledgements

I would like to thank my mentor Dr. Pamela A. Smoot for her guidance, the McNair scholars program for providing such a wonderful opportunity, and the COLA Dean’s office providing and work space. This research would not have been possible without SIU Reference Librarians Matt Borowicz and Philip Howze, the Harvard University medical school Archives, and the Historical libraries and State Archives of Colorado, Kansas, Nebraska, and Oklahoma and their efforts to assist me in with this project. I would remiss if I did not acknowledge Ms. Rhetta Seymour and Ms. Jordan Thomas for their patience and dedication to the McNair scholars program.
Civil Asset Forfeiture and Excessive Fees in the American Criminal Justice System: A Blatant Constitution Violation?

Joshua McCray & Dr. Benjamin Bricker
Political Science Department
History and Political Science Major

Abstract

Asset forfeiture is a practice that has existed in the United States since the founding of this country. However, since the 1970s civil asset forfeiture in particular has been a common tactic used by police in their fight on the War on Drugs in the United States. The impact of asset forfeiture and often particularly civil asset forfeiture on policing has been widely discussed in the academic community. However, even though civil asset forfeiture is a popular tool used by law enforcement, it has gained a lot of critics both by academics and the American public. Along with excessive fines levied by police and the court system civil asset forfeiture is a highly controversial policing method with numerous constitutional violations and racist practices and racial profiling.

Objectives

- Understand court cases and laws that have impacted civil asset forfeiture
- Examine the Ferguson Justice Department Report on fees in Ferguson, Missouri
- Examine racial bias in asset forfeiture and administration of court fees

Cases

- Timbs v. Indiana (2019) - Incorporated Eighth Amendment Excessive fines clause
- Austin v. United States (1993) - Excessive fines case attempting to seize home and business
- Bennis v. Michigan (1996) - “Innocent owner defense” Fifth Amendment takings clause with property/ Fourteenth Due Process clause

Laws

- Comprehensive Crime Control Act of 1984 - Allows states to keep forfeiture proceeds creates equitable sharing
- Civil Asset Forfeiture Reform Act 2000 - Shifts burden of proof from individual to government and also creates a uniform innocent owner defense
- Comprehensive Drug Abuse and Prevention Act - Creates modern day civil asset forfeiture and sparks legislation beginning War on Drugs

Excessive Fees

- Communities rely on fees levied by the court to generate revenue for their community
- Ferguson, Missouri was investigated by Department of Justice
- Report found that Ferguson, Missouri targeted people of color to generate community revenue
- Faced fines for ordinance/ traffic violations and required to pay cash at courthouse

Policing for Profit

- Law enforcement agencies often police communities with the largest financial incentives.
- In Chicago and Montgomery, Alabama the majority of seizures and stops occur in low income minority neighborhoods.
- Seizures and searches often target minorities due to their lack of access to national banks.
- Police use forfeiture to generate revenue both for community as well there own budgets.

Equitable Sharing

- Created under President Reagan with 1984 CCCA
- Federal Legislation that allows states to keep 100% of proceeds from state forfeitures
- Allows states to share in proceeds of federal forfeiture
- States also practiced Adoptive Forfeitures (e.g. Missouri)
- States utilize federal government to avoid state regulations on forfeiture so they can receive 80% of forfeiture proceeds
- Adoptive Forfeiture ended in 2015 under Attorney General Eric Holder due to abuse

Three Types of Forfeiture

- Administrative (by the agency)
- Civil In rem (against the property)
- Criminal in personam (against the person)

Proposals for Reform

- End equitable sharing
- End civil asset forfeiture and require all forfeitures to be in personam
- Raise the burden of proof from preponderance of the evidence to beyond a reasonable doubt
- Require charge and conviction for forfeiture
- Pass legislation that requires CAFRA to apply to states
- End the War on Drugs
- Require budgets for police agencies be generated by the tax payers and other community incentives instead of using asset forfeiture to generate revenue
- Allow legal representation during forfeiture proceedings
- Law enforcement agencies get one chance at forfeiture and conviction

State Keep Rate 1984

- Prior to 1984 CCCA
- No equitable sharing laws
- No federal forfeiture funds
- States with 100% keep are located in deep South and Northwest
- Florida, Georgia, Alabama, and Texas: history of slavery, Jim Crow, and racial oppression
- Idaho and Montana: sparsely populated states
- Forfeiture highly prominent due to a small tax base
- 100% states are traditionally red and supporters of Nixon and Reagan.

Keep in personam (against the person)

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United States Justice Department Civil Rights Division, Investigation of Ferguson Police Department. 2015

Acknowledgements

- Supported, in part, by the McNair Scholars Program with additional thanks to:
  - Dr. Benjamin Bricker (McNair mentor)
  - Jorden Thomas (McNair Scholars)
  - Rhetta Seymour (McNair Director)
  - Dr. Jose Najar (Professor History Dept.)
  - Dr. Pamela Smoot (additional Mentor Professor History Dept.)
**ABSTRACT**

*Chlamydia trachomatis* is a major public health concern as infections may lead to serious diseases including blindness from trachoma as well as infertility, ectopic pregnancies, and pelvic inflammatory disease (PID) from the sexually transmitted infection known as chlamydia. *Chlamydia* spp. convert between two forms in a biphasic developmental cycle, the infectious elementary body (EB) and the replicative reticulate body (RB). While the two forms are well characterized, the mechanisms governing and performing the differentiation processes are virtually unknown. Phosphorylation is being analyzed as a form of post-translational control of protein function in pathogens. It plays important roles in signal transduction cascades and in regulating enzymatic activity. Ser/Thr/Tyr phosphorylation of proteins in bacteria has been increasingly recognized as an important mechanism of post-translational control of protein function in pathogens. *Chlamydia* spp. has two validated Hanks type kinases, Pkn1 and PknD, encoded in *Chlamydia trachomatis*. This will be done by co-expressing potential substrates with Pkn1 or PknD in *Escherichia coli*. The proteins will then be analyzed for phosphorylation status using Phos-tag SDS-PAGE. The results from this work will be used to map kinase-substrate networks in *Chlamydia* and to identify phosphorylation motifs, enabling directed studies on how phosphorylation impacts substrate function.

**RESULTS**

Table 3. The phosphorylation status of substrates when co-expressed with Pkn1 or PknD.

<table>
<thead>
<tr>
<th>Name</th>
<th>Pkn1</th>
<th>PknD</th>
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<tr>
<td>AaxB</td>
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</tr>
<tr>
<td>Hsp60_3</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>RsbV2</td>
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<td>No</td>
</tr>
<tr>
<td>FHA1</td>
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<td>No</td>
</tr>
<tr>
<td>FHA2</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>CdsN</td>
<td>No</td>
<td>Unclear</td>
</tr>
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</table>

**FUTURE DIRECTIONS**

- Substrate genes will be cloned, screened for expression, and then for phosphorylation status. Selection of substrates will be based on protein function/localization.
- Results will be used to identify phosphorylation motifs, enabling studies on how phosphorylation impacts substrate function.

**ACKNOWLEDGMENTS**

I would like to thank Dr. Derek Fisher, Tayla Harvey, and Rhetta Seymour for their support throughout the McNairs Program.

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McNair Scholar Program.
**Introduction**

*Heterocephalus glaber*, more commonly known as naked mole-rats are a hypotonic, hypercapnic, and subterranean species that are commonly found in the eastern parts of Africa (Jarvis, Sherman 2002). *H. glaber* is known for its unique longevity because they have a lifespan of approximately 30 years, which is one of the many reasons this animal model has received so much interest. Naked mole-rats are eusocial and extremely territorial, living in colonies up to 300 conspecifics with strict social divisions. Naked mole-rats utilize their incisors for feeding, construction of their very complex tunnel systems, and social interactions (or defense) in their eusocial colony structure. These rodents rely heavily on their incisors, rather than their other sensory systems since they are subterranean.

**Objective**

- This project focuses on nicotinamide adenine dinucleotide phosphate diaphorase (NADPH-d) staining for the chemoarchitectonic atlas. This atlas is used to help identify brain structures, not only on the conventional Nissl-stained sections but also with additional stains of interest (Paxinos, 1999).
- NADPH-dihorase is commonly used by neuroscientists for its ability to inhibit nitric oxide synthase, which provides a specific histochemistry marker for neurons producing nitric oxide (Hope et al., 1991). NADPH-dihorase histochemistry results in Golgi-like staining of select neurons throughout the nervous system that are exhibiting this activity, which has led to the recent use of this staining technique in neuropathological studies (Hope, Vincent 1988).

**Methodology**

- All procedures were approved by the Institutional Animal Care and Use Committee. Two naked mole-rats were perfused with 0.01 M phosphate buffer saline (PBS), followed by 4% paraformaldehyde (PFA) in PBS.
- Following perfusion, the brains were immediately extracted and post-fixed in 4% PFA for 24 hours.
- After post-fixation the brains were placed in 30% sucrose 0.02 M phosphate buffer saline solution for 1-2 days until saturated.
- Each brain was coronally cut 40µm using a cryostat. Sections were post-fixed in 4% PFA for 24 hours.
- After post-fixation the brains were placed in 30% sucrose 0.02 M phosphate buffer saline solution for 1-2 days until saturated.
- Each brain was coronally cut 40µm using a cryostat. Sections were stained with Cresyl Violet (Nissl), and adjacent series were processed for NADPH-d, parvalbumin, calbindin D28K, calretinin, SMI-32, tyrosine hydroxylase, vesicular glutamate transporter 2, and acetylcholinesterase. Brain sections were identified and compared with those found in similar naked mole-rat studies such as the stereotaxic atlas of the naked mole-rat brain (Xiao et al., 2006).

When developing the protocol for the NADPH-d histochemistry on *H. glaber* there were a few adaptations that had to occur when referring to the chemoarchitectonic atlas of the rat brain. First, the allotted time for the sections to sit in the stain was 38hrs for a rat brain, however we reduced the time down to 24 hours, which resulted in less background. We also had to change the amount of time the mounted and stained section set in 100% Alcohol from three to four hours to remove more background so that we could fully differentiate between the background and the present neurons.

**Results**

- Figure 1. Staining resulting from NADPH-diaphorase using methods described in (Paxinos, 1999). 42 hours in staining solution and 3 hours in 100% Alcohol). Background staining was too dark using this method. Scale bar = 2mm
- Figure 2. Staining resulting from NADPH-diaphorase using alternative methods described in (Paxinos, 1999). 24 hours in staining solution and 3 hours in 100% Alcohol). Background staining still too dark using this method. Scale bar = 2mm
- Figure 3. Staining resulting from NADPH-diaphorase using alternative methods described in (Paxinos, 1999). 24 hours in staining solution and 4 hours in 100% Alcohol). Background staining light enough to differentiate between present neurons. Scale bar = 2mm

**Conclusion**

Based on our findings, we are now using the method that resulted in Figure 3. This method resulted in the least amount of background. That is important because we need to be able to fully differentiate between the background and neurons that are present within this stain. Once the chemoarchitectonic atlas of the naked mole-rat brain has been fully completed future researchers will be able to refer to it for descriptive purposes.

**References**


**Acknowledgements**

This research was supported in part by the SIU McNair Scholars Program. I would also like to thank Dr. Joseph Cheatwood and Dr. Diana Sarko for the use of their laboratories.
Does Location Matter?
Domestic Violence From A Geographical Perspective
Shalane Scott & Dr. Julie Hibdon
Department of Criminology & Criminal Justice

The objective of this study is to examine domestic violence from a geographical perspective. Using Seattle, Washington Police incident data and the Seattle, Washington government website, the types of domestic violence and how each case was handled is analyzed. There are few research studies on domestic violence from a geographical perspective. Research has shown there is a relationship between location and domestic violence. In this study compared to others, we examine domestic violence on 10 specific streets instead of a large city. This research examines the relationship between alcohol accessibility by foot and domestic violence. Using google maps we were able to see the proximity between alcohol accessibility and each street address. The study also examines the availability of women’s shelter by foot, and domestic violence within low income houses. What we discovered was only 2 out of the 10 addresses examined were considered low income housing. Only 5 out of the 10 address have access to alcohol compared to what many articles have mentioned. Lastly, out of the 10 streets only 4 had access to a women’s shelter.

Abstract

Hypotheses

- There are more domestic violence incidents in low income houses.
- Alcohol accessibility increases domestic violence.
- Lacking accessible resources increases domestic violence.
- Police have a delayed response to domestic violence or they do not respond.

Methodology

- Analyzed Months
- Gathered/Analyzed Streets
- Examined Reports
- Google Earth
  - Compared to Articles
  - Analyzed Physical Locations
- Examined the Handling of Reports
- Proximity
  - Alcohol
  - Women's Shelter

Results

<table>
<thead>
<tr>
<th>TYPES OF DOMESTIC VIOLENCE</th>
<th>Frequency</th>
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</thead>
<tbody>
<tr>
<td>Vulnerable adult, Physical Abuse</td>
<td>16</td>
</tr>
<tr>
<td>Vulnerable adult, Neglect</td>
<td>22</td>
</tr>
<tr>
<td>Vulnerable adult, Financial Abuse</td>
<td>26</td>
</tr>
<tr>
<td>Enforce Court Order</td>
<td>649</td>
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<tr>
<td>Assist Victim by Court Order</td>
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<tr>
<td>Service of Court Order</td>
<td>1073</td>
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<tr>
<td>Standby to Assure Peace</td>
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</tr>
<tr>
<td>Assault (Mandatory Arrest)</td>
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<tr>
<td>Arrest Discretionary</td>
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<tr>
<td>Arugments, Disturbance (No Arrest)</td>
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<tr>
<td>Threats by phone or writing</td>
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<table>
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</tr>
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<table>
<thead>
<tr>
<th>HANDLING OF REPORTS</th>
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<td>Assistance Rendered</td>
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<tr>
<td>Physical Arrest Made</td>
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<tr>
<td>Report Written (No Arrest)</td>
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<td>Unable to Locate Incident or Complainant</td>
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<table>
<thead>
<tr>
<th>PROXIMITY TO ALCOHOL &amp; WOMEN'S SHELTER</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>325 9 AV</td>
</tr>
<tr>
<td>13030 LINDEN AV N</td>
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<td>149 NW 80 ST</td>
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<td>1902 2 AV</td>
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<td>4206 S CHICAGO ST</td>
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<td>14100 LINDEN AV N</td>
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Conclusion

- The accessibility of alcohol did not affect the amount of domestic violence.
- The lack of resources for domestic violence victims did not affect the rate of domestic violence.
- Police do respond to domestic violence victims and want to take action.
- The majority of the victims do not want the offender arrested.
- There are certain months that have an increase in domestic violence.
- Domestic violence happens in other homes besides low income houses.

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