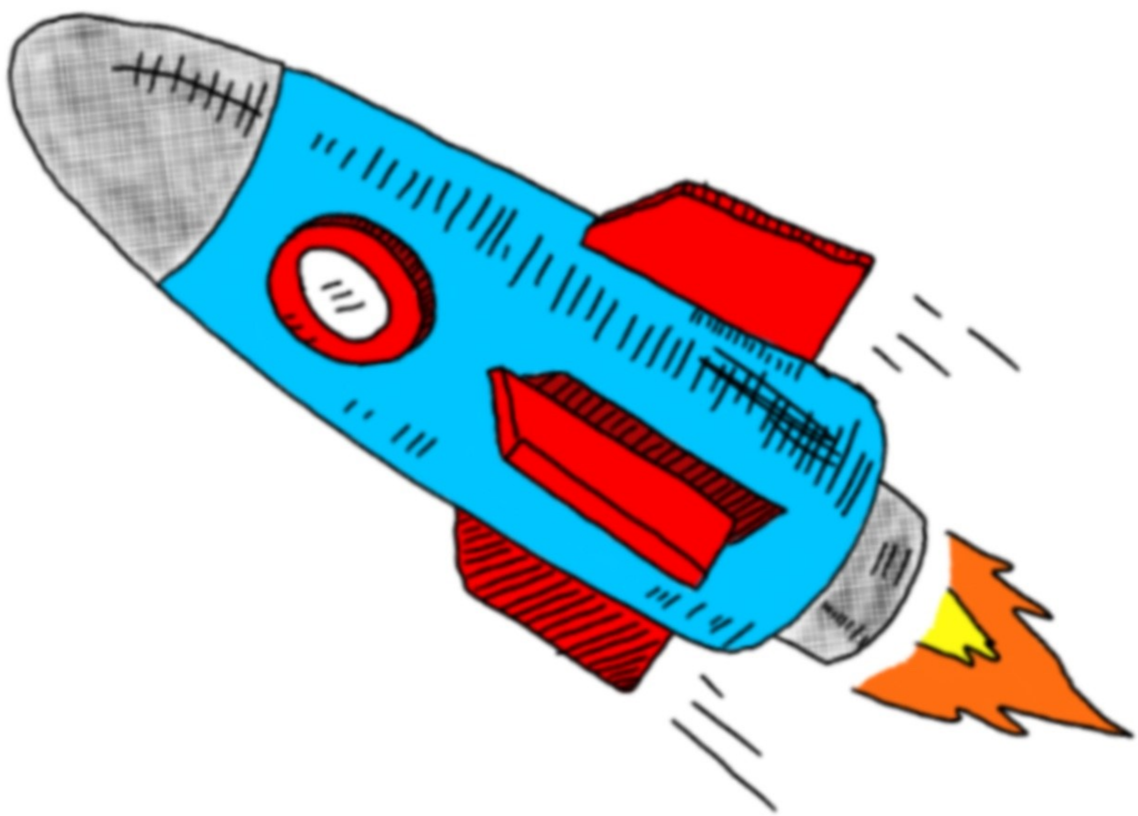
2019

Momentum 2019

Stephanie Clarke



Momentum

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Momentum

Faculty Reviewers

Dr. Lauren King,, Assistant Professor of Biology

Dr. King earned her doctorate in Microbiology from the University of Mississippi Medical Center in 2011. She then served as a postdoctoral fellow at Wake Forest University from 2012-2014 before accepting a position as an Assistant Professor of Biology at Columbus State University. Dr. King is now in her fifth year at CSU and teaches a wide variety of courses including Principles of Biology, General Biology, Organismic Biology, Bioterrorism, Microbiology for the Health Sciences, Microbial Pathogenesis, Immunology, and a study abroad class focused on health issues in the Bahamas. Her primary research interests include bacterial pathogenesis, host-pathogen interactions, and antibiotic resistance.

Dr. Jim Owen, Professor of English

Jim Owen is a Professor of English at Columbus State University, where he has been teaching for 24 years. Before joining the CSU faculty, Professor Owen taught at James Madison University, the University of Virginia, and North Carolina State University. He received his PhD from the University of Virginia; his area of expertise is British Literature of the Restoration and 18th Century.

Dr. Mark Schmidt, Professor Department Chair of Psychology

Dr. Schmidt earned his doctorate in Psychology, with a concentration in biological psychology, from the University of Georgia in 1999 and has worked at Columbus State University since that time. He is currently serving as Chair of the Department of Psychology at Columbus State University. Dr. Schmidt teaches Biological Psychology, Sensation and Perception, History and Systems of Psychology, Comparative Animal Behavior, and Psychology as a Major and Career. His research interests includes aspects of brain function, perception, and cognition in humans and non-human animals.

Dr. Katherine R.G. White, Assistant Professor of Psychology

Dr. White earned her doctorate in Psychology, with a concentration social cognitive neuroscience, from the University of Texas at El Paso in 2012. She worked as an Assistant Professor at Columbus State University from 2012 to 2016, and began her tenure as an Assistant Professor at Kennesaw State in the fall of 2016. At KSU, Dr. White teaches Research Methods Statistics, Science of Psychology, Social Psychology, Cross-Cultural Psychology, and the Psychology of Diversity. Her primary research interests include intergroup race relations, social perception, and cultural influences on these processes.

Letter from the Provost

Dear Friends,

I am very excited to share with you this year's publication of *Momentum*, Columbus State University's innovative publication promoting undergraduate research at Columbus State University as well as at universities across the country and beyond. This peer-reviewed journal provides a professional academic venue for our undergraduates to share the scholarly work they are engaged in with faculty mentors and their peers.

As a fairly new member of the Columbus State University community, I have been thoroughly impressed with the strong commitment on our campus to engaging undergraduates in meaningful research experiences. Faculty members across all disciplines serve as mentors and imbue students with the knowledge, skills, and passion for research in their chosen fields. Through this research, students are not only gaining knowledge, but creating new knowledge to advance their respective fields and disciplines.

The *Momentum* editorial staff, comprised of undergraduate students from a variety of academic majors, is strongly committed to providing scholars at all levels with a broad scope of research with varying levels of complexity and significance. Dr. Lauren King serves as the faculty advisor and supports the editorial staff. She empowers these students to expand their horizons and develop as scholars and leaders as they make editorial decisions for this publication.

I think you will find the scholarly articles in this issue stimulating and informative. The student researchers' vision and dedication to academic inquiry are evident throughout this latest edition. I commend the editorial staff of *Momentum* for a job well done!

Sincerely,

Deborah E. Bordelon, Ph.D.
Provost and Executive Vice President

Editor's Note

Dear Readers,

When I first joined *Momentum*, the entire editorial board had just graduated from Columbus State University CSU and simultaneously retired their duties as editors. As would be expected, *Momentum* fell apart in the time between their synchronous graduation and the recruitment of three inexperienced editors, myself included, to the editorial board. It took several months of collaborative effort to rebuild the editorial board, learn the ways of scholarly publication, and revive and revamp the student organization, but in time we began to see an influx of submissions from a handful of universities and an increased interest among the student body at CSU. To say the least, this was extremely gratifying and encouraging. I attribute our success to a mutual love of research, collaborative skills, and an interest in the publication process itself.

As I have learned through my own experiences, the goal of undergraduate research is to not only learn from successes, but also to learn from blunders and failures. Our intent is to provide a platform for undergraduate researchers to demonstrate that they have learned from their research experiences--good and bad--and communicate their findings in a coherent and professional manner. We hope that we have achieved this goal with this issue and that you find its contents interesting and insightful. Perhaps, if you are an undergraduate yourself, you will see from your peers' work that research experience and publication is fun, educational, and obtainable with some networking and determination. If you have not forayed into the world of research yet, I hope this issue will inspire you to do so, or at least have a greater appreciation for the tedium researchers at all levels of scholarship must go through to contribute to the universal library of knowledge and, in turn, help society at large.

Best,

Stephanie Clarke

Editor-in-Chief

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Research

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Antimicrobial Activity of Novel Cationic Amphiphiles

Abstract

This project focused on the development of amphiphiles in order to prevent hospital-acquired infections before they have a chance to enter the host, thereby reducing the need for antibiotics. The antibiotic resistance crisis of the 21st century is a dangerous epidemic with global consequences. Therefore, there is a desperate need for novel approaches in antimicrobial research. This would decrease the overall length of stay in hospitals and costs associated with such a stay. In this study, tetracationic amphiphiles with two 12-carbon chains and an aliphatic linker were studied. The MIC value of each amphiphile and strain pair was determined and compared. Linker length, the distance between head groups attached to identical hydrophobic tails appears to affect antimicrobial activity. Amphiphiles with longer linkers tend to be more potent antibacterial agents than those with shorter linkers. Amphiphiles were also used in combination with antibiotics to determine whether the combinations interacted synergistically to kill bacteria. The most potent amphiphile was 12-B-10-B-12 against all bacteria. This amphiphile was longer in linker length relative to other derivatives, suggesting that there is a relationship between linker length and antimicrobial potency. The development of novel amphiphiles may be one way to reduce the need for antibiotics to treat hospital-acquired infections.

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Mentor: Dr. Kyle Seifert, Professor, Department of Biology, James Madison University

Biography

My name is Melanie Kusakavitch. I was born in Pittson, Pennsylvania. I am 22 year old and graduated in May 2018 from the James Madison University in Harrisonburg, Virginia with a degree with Honors of Distinction in Health Sciences and minors in Biology, Pre-Medicine, and Honors Interdisciplinary Studies. While diving into my academics, I competed as a Division I athlete for the nationally ranked Dukes and posed as the captain for two of my four years on the team. I am currently furthering my academic career by getting a Masters in Biomedical Sciences at Geisinger Commonwealth School of Medicine in Scranton, Pennsylvania. I hope to pursue a career in medicine in the future and dedicate my life to service of others and lifelong learning.

Citation format: APA

Category: Sciences

Antimicrobial Activity of Novel Cationic Amphiphiles

In 2013, the CDC reported more than two million Americans are infected with an antibiotic-resistant bacterial infection each year, contributing to more than 23,000 deaths in the U.S. per year CDC, 2013 These infections span a diverse list of illnesses including skin and surgical site infections, urinary tract infections, pneumonia, bacteremia, and hospital-associated diarrhea. Approximately 2 million patients contract a healthcare-acquired infection each year Klevens *et al.*, 2007 at a cost of $28 - $33 billion in healthcare annually Scott, 2009 . The cost of antibiotic-resistant infections to a single hospital has been estimated to be as high as $13.35 million a year Scott, 2009 . In the past 15 years, only four novel antimicrobial classes have been approved for clinical use. Resistance to these agents has already been observed in enterococci and staphylococci Klevens *et al.*, 2007 . Infections from antibiotic resistant bacteria have become more prevalent in the 20th century. There are growing challenges in treating these infections; therefore clinicians must work to limit the transmission of bacteria between contaminated equipment and/or staff to susceptible individuals. This is critical for preventing nosocomial infections and reducing mortality rates.

When the introduction of antibiotics, antiseptics, and disinfectants came into existence, public health was forever modified. These compounds were able to improve sanitation methods and reduce the spread of infectious diseases, most specifically in health care settings Sköld, 2006 . Communicable diseases, such as tuberculosis, pneumonia, and diarrhea, once ranked as top killers globally, now have been replaced by many chronic conditions due to the use of antimicrobials Kochanek *et al.*, 2011 .

Although this generation has seen many benefits from the use of antimicrobials in controlling these infections, hospital-acquired infections HAI have posed a major threat to patients receiving health care. These infectious agents are dangerously gaining resistance to commonly used antimicrobials. HAIs frequently lead to increasing medical costs, longer hospital stays, increasing complication rates, and worsening overall morbidity and mortality Klevens *et al.*, 2007 . Many countries and hospitals have adopted policies and regulations in recent years attempting to decrease the impact of these healthcare-associated infections. Not only would reducing HAIs be beneficial to the patients themselves, it would also be highly beneficial to healthcare centers and insurance companies Scott, 2009 .

An increasing proportion of HAIs are resistant to various antibiotics. The rate of *Staphylococcus aureus* strains found in hospitals that were methicillin-resistant is increasing. MRSA, methicillin resistant *Staphylococcus aureus*, was once detected at a rate of 1-5% in the 1980's to 60-70% in recent years, proving greater incidence Taubes, 2008 . Multi-drug resistant *Pseudomonas aeruginosa* has become relatively common in Intensive Care Units ICUs , accounting for 13.2% to 22.6% of HAIs reported in this environment Driscoll *et al.*, 2007 . Bacterial drug-resistance forces healthcare providers to resort to more expensive and potentially more harmful therapies McGowan, 2001; Cosgrove   Carmeli, 2003 . Patients with infections that are resistant to all available antibiotics often have to undergo surgical removal of the infection, which may include amputations Cosgrove   Carmeli, 2003 .

The rapid emergence of resistant bacteria has diminished the efficacy of antibiotics. The antimicrobial resistance of many pathogenic bacteria can be attributed to the regular overuse and misuse of antibiotics Ventola, 2015 . Unfortunately, resistance has been documented for almost all antibiotics developed. Despite the known danger of antibiotic resistance, antibiotics are continually misused, overprescribed, and abused in a number of industries including agriculture. Industrial use has contributed greatly to the vast increase in antibiotic resistance, particularly in human pathogens such as methicillin-resistant *S. aureus* MRSA , vancomycin-resistant enterococci VRE , and multi-drug resistant *P. aeruginosa* and *Mycobacterium tuberculosis* MDR-TB   Gilbert   Moore, 2005 . This increase has diminished the effectiveness of first- and second-line therapies for infectious disease, extending illness, and increasing the risk of mortality Taubes, 2008 .

Proper hygienic practices, including hand washing, are the easiest, most effective and cost efficient ways to prevent HAIs Braine *et al*, 2009 . Reducing surface contamination is one way that infections can be combated. Surface contamination can be extremely problematic when contaminated surfaces come in contact with a patient's open wound or surgical equipment, catheters, or ventilators used on a patient Weber *et al.*, 2010 . This potential contamination has increasingly negative effects on patients in hospitals, particularly those with compromised immune systems. Reducing potential cross contaminations between health care professionals and patients, whether it be by contact between persons or contact with hospital equipment prevents pathogen reservoirs from forming and reduces the risk of infection for patients. The need for novel antimicrobials is extremely important during this time of antibiotic resistance.

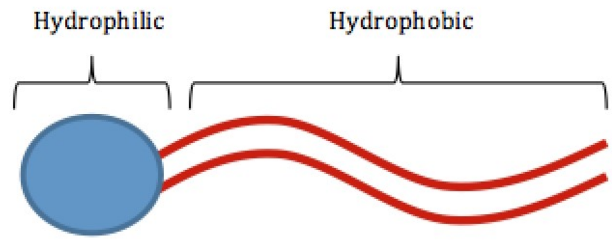


Figure 1. Generic amphiphile structure, including the hydrophilic head group (blue) and the hydrophobic hydrocarbon tail group (red).

Cationic amphiphiles, compounds with at least one hydrophilic head group and hydrophobic tail Figure 1 , can have antibacterial properties. It is generally thought that amphiphiles work by targeting the cell membranes of bacteria. The amphiphile's positively charged head group interacts electrostatically with the negatively charged cell membrane of the bacterium, allowing hydrophobic tails to insert into the membrane and disrupt or destabilize it. When the membrane is disrupted, cytoplasmic materials leak out and cell lysis occurs. Gilbert   Moore, 2005 . Amphiphiles have served as antimicrobial agents in many industries. For example, benzalkonium chloride and chlorhexidine are active ingredients in topical antiseptics such as Neosporin®, mouthwash, and common disinfecting products, including Lysol® Gilbert   Moore, 2005 . These compounds have been successful for many decades and bacteria have no documented resistance to them Gilbert   Moore, 2005 . Therefore, there is great potential for cationic amphiphiles as antimicrobials.

Gemini amphiphiles, which contain four cationic head groups with two attached 12-carbon tails and a linkage group Figure 2 , are the main focus of this research because of their proven potent antimicrobial activity against Gram-negative and Gram-positive bacteria. Dialkyl 4,4'- bipyridium amphiphiles with 12 carbon tails have been recognized as a potentially efficient group of membrane disruptors Grenier *et al.* 2012 . Dialkyl 4,4-bipyridium compounds, which include a gemini two heads, two tails structure Figure 2 , are effective against highly resistant bacterial strains such as *E. coli and P.aeruginosa* Grenier *et al.* 2012 . The compounds specifically used in this study all possess a 12-carbon tail. What is unique about each compound is the linker length varying from 6-12-carbons in length Figure 2 . Each of these amphiphiles possesses a tetracationic structure, with four head groups that possess a total of 4 positive charges.

There is much interest in developing single antimicrobials or combinations of drugs that have activity against multiple microorganisms Giacometti *et al,* 2000. Tobramycin is an aminoglycoside antibiotic that is used to treat various types of bacterial infections, particularly Gram-negative infections. It is especially effective against species of *Pseudomonas*. Oxacillin is a penicillinase-resistant antibiotic that is widely used clinically in the United States to treat penicillin-resistant bacterial infections, such as ones caused by *S. aureus* Jones *et al,* 2002 . In this study, novel amphiphiles were used in combination with different antibiotics, tobra-

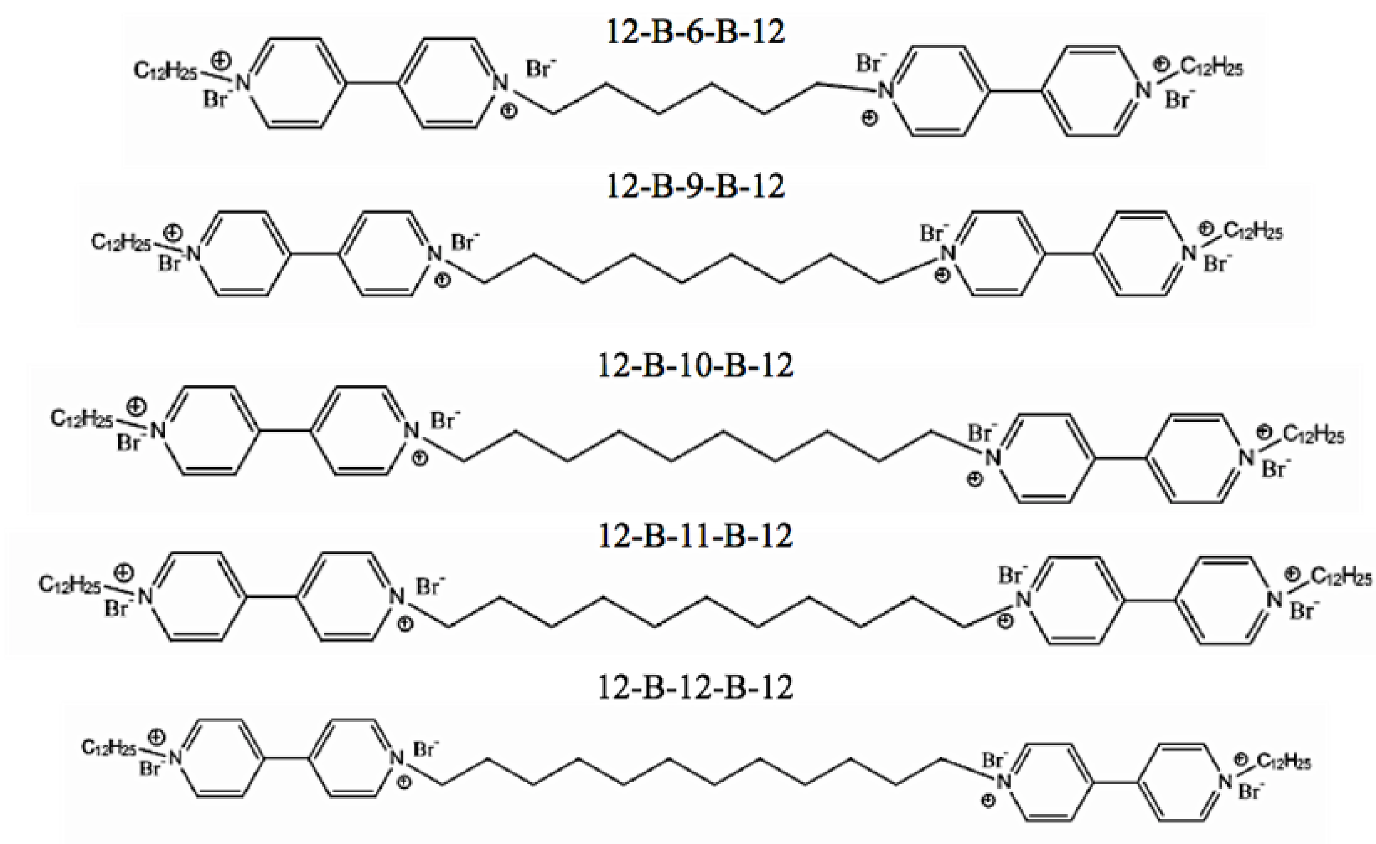


Figure 2. Dialkyl 4,4'-bipyridium amphiphiles.

mycin and oxacillin, to determine if the combinations interacted synergistically to kill bacteria. The antibacterial activity of a series of 4,4'-bipyridinium compounds against Gram- positive and Gram-negative pathogens was investigated to further analyze the effects of various structural features on antibacterial activity. In this study, antimicrobial properties of novel amphiphiles were explored by determining MIC values. These MIC values were determined and analyzed in order to determine the relationship between linker length and antimicrobial activity of amphiphiles. Amphiphile 12-B-10-B-12 was a potent killer against all Gram-positive and Gram-negative bacteria.

Combination assays were then performed in order to detect possible synergistic relationships between other novel amphiphiles and tobramycin and oxacillin. Although no significant results were obtained with these specific combinations, preliminary experiments suggest that amphiphiles in this study are potent antimicrobials.

Method

Bacterial Strains and Growth Conditions

The Gram-negative bacterial strains used in this study were *Escherichia coli* ATCC® 25922™, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* ATCC® 27853™ for experiments with planktonic cells, and hyper-biofilm forming strain PAO2 for biofilm disruption studies Holloway, 1955 . The Gram-positive bacterial strains used were *Staphylococcus aureus* subsp. *aureus* ATCC 29213™, *Enterococcus faecalis* ATCC® 29212™, *Bacillus anthracis* Sterne, *Streptococcus agalactiae* J48 Seifert *et al*., 2006 . All bacterial strains, except for PAO2 were grown in MHB. For biofilm studies, PAO2 was grown in Luria-Bertani LB broth.

Broth Microdilution Method for Determining the Minimum Inhibitory Concentration

Students from James Madison University under the direction of Dr. Kevin Caran synthesized the amphiphiles in this study. The Minimum Inhibitory Concentration MIC was determined for each amphiphile against four Gram-positive and three Gram-negative bacterial strains as previously described CLSI, 2012 . The MIC was determined using the broth microdilution method Wayne, 2009 . Bacterial cultures were grown overnight at 37°C and diluted in MHB to a concentration of $5x10^6$ cells/mL. Aliquots of 100µL of bacteria were added to 96-wells plates along with 100µL of amphiphile being tested at 2-fold dilutions, from 500µM to 2µM, in triplicate. The plates were incubated at 37°C for 72 hours. The wells with the lowest concentration of amphiphile without visible growth were considered the MIC. Each amphiphile was tested a minimum of 2 times.

Checkerboard Assay

A checkerboard assay using 96-well microtiter plates was used to determine if synergy exists when amphiphiles are combined with other compounds against *E.coli* ATCC® 25922™ and *S. aureus* ATCC® 29213™ ATCC, Manassas, VA, USA . Bacteria diluted to $5x10^6$ cell/mL was added to each well yielding $5x10^5$ cell/mL in each well. Wells with sterile deionized H_2O treatment were used as a control for bacterial growth. In the checkerboard section of the assay, 50µl of each compound at 2-fold dilutions at concentrations below the previously determined MIC of each compound was added to individual wells, such that multiple combinations of the two compounds are tested on a single plate. The Fractional Inhibitory Concentration FIC was determined by comparing the MIC value of each compound alone and in combination using the following equation:

$$FIC \quad FIC_A + FIC_B$$

$$FIC_A \quad A/MIC_A$$

$$FIC_B \quad B/MIC_B$$

MIC_A and MIC_B represent the MIC of compound A and B alone and A and B represent the MIC values of compound A and compound B combined. Synergy was defined as an FIC value of <0.5, and antagonism was defined as an FIC value of >4. Synergy assays for each combination was performed at least 3 times.

Results

Effect of Varying Linker Length of Gemini Bipyridium Amphiphiles on antibacterial activity

To determine the effect of varying linker length on antimicrobial activity, MIC assays were performed with dialkyl 4,4'-bipyridium amphiphiles that had varying linker lengths ranging from 6-12 carbons Table 1, 2 . The variation in linker length resulted in a trend that as linker length increases, MIC values decrease for species such as Gram-negative, *K. pneumonia* Table 2 . As linker length increased, MIC values increased, for Gram-positive species such as *E. faecalis* and *S. aureus* Table 1 , showing that, in this case, shorter linker lengths were more effective. When 4,4'-bipyridium amphiphiles treated Gram-positive *S. agalactiae* and *B. anthracis* there showed promising results but no definitive trends Table 1 . When 4,4'-bipyridium amphiphiles treated Gram-negative *P. aeruginosa* and *E.coli* again, there showed no definitive trends Table 2 . Overall, the most effective amphiphile was 12-B-10-B-12 against all bacteria Figure 3,4 , showing that a linker length of 10-carbons was optimal. Amphiphiles were generally more effective against Gram-positive bacteria than they were against Gram-negative bacteria. *B.anthracis* appears to be most sensitive to all amphiphiles tested Figure 3 .

Effect of Synergy between Cationic Amphiphiles and Antibiotics on E. coli

Four series of double tailed tris-cationic amphiphiles were synthesized by the Caran lab James Madison University . For each series, the amphiphiles consisted of a mesitylene core M with three attached positively charged head groups. Two of these head groups were dimethylalkylammonium groups with attached hydrocarbon tails. The third head group was either ethanolammonium for the M-E,n,n series, dimethylaminopyridinium for the M-DMAP,n,n series, isoquinolinium for the M-IQ,n,n series, and 4-pyridine propanol for the M-4PP,n,n series. The hydrocarbon tails were linear and symmetrical, and consisted of 12 carbons for all of the amphiphiles in this series.

Table 1. Minimal Inhibitory Concentrations µM for amphiphiles against Gram-positive bacteria.

n-B-n-B-n	*E. faecalis*	*S. aureus*	*S. agalactiae*	*B. anthracis*
12-B-6-B-12	8	4	4	2
12-B-9-B-12	8	8	4	2
12-B-10-B-12	8	4	1	1
12-B-11-B-12	16	32	4	1
12-B-12-B-12	16	16	1	4

Table 2. Minimal Inhibitory Concentrations µM for amphiphiles against Gram-negative bacteria.

n-B-n-B-n2	*P. aeruginosa*	*E. coli*	*K. pneumoniae*
12-B-6-B-12	32	16	32
12-B-9-B-12	16	16	16
12-B-10-B-12	16	8	8
12-B-11-B-12	8	16	8
12-B-12-B-12	16	16	4

The tetra-cationic amphiphile series were structured similarly, however two dimethylalkylammonium head groups were attached to each of the same positions on the central ring, connected by a 2-carbon linker. The linear hydrocarbon tail connected to the head group in each of the tetra-cationic series contained 8 or 10 carbons for the pX- 2,n $_2$ series Figure 6 .

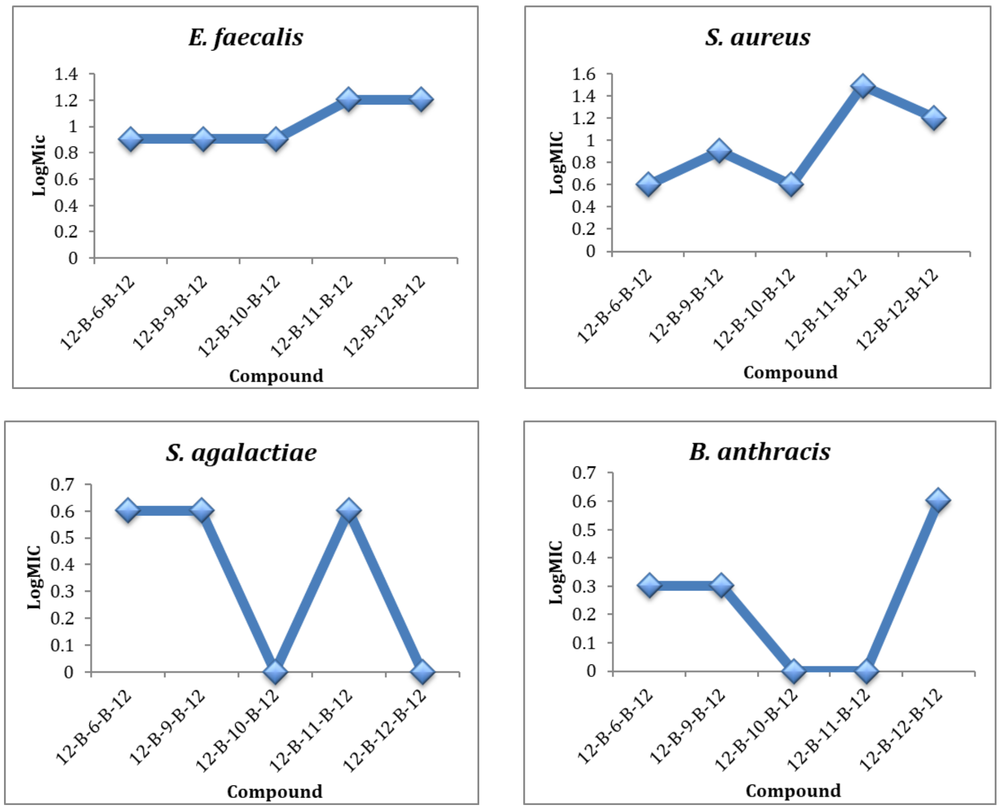


Figure 3. Log [MIC µM] values of dialkyl 4’4 bipyridium amphiphiles for Gram-positive bacteria.

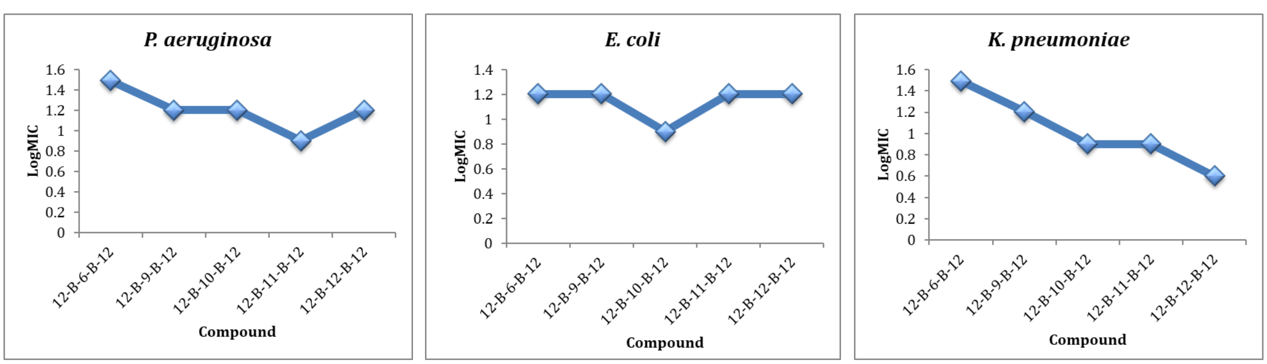
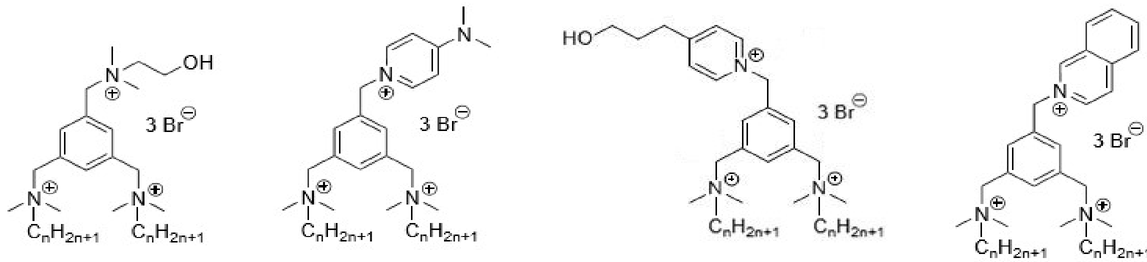
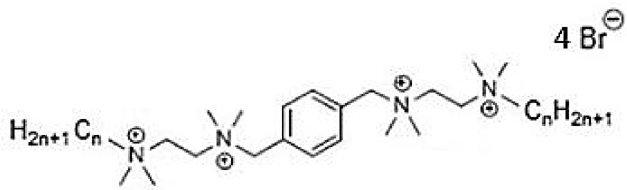


Figure 4. Log [MIC µM] values values of dialkyl 4’4 bipyridium amphiphiles for Gram-negative bacteria.



M-E,n,n series M-DMAP,n,n se- M-4PP,n,n se- ries M-IQ,n,n se-

Figure 5. Structure of amphiphiles. *M* represents the Mesitylene core; *n* represents the number of carbons in each symmetrical hydrocarbon tail. *E* ethanolammonium, *DMAP* dimethylaminopryidinium, *IQ* isoquinolinium, and *4PP* 4-pyridine propanol.



pX- 2,n 2 series
n 8,10

Figure 6. Structure of tetra-cationic amphiphiles. *n* represents the number of carbons in each symmetrical hydrocarbon tail.; *pX* para-orientation.

Tobramycin and oxacillin are both known to be effective antibiotics and were combined with these amphiphiles to determine if they acted synergistically when used on *E. coli.* Based on the FIC values, there was not synergy with any of these combinations Table 3 , though it was close in some cases e.g., PX 2,8 2 .

Table 3. FIC values for amphiphile and antibiotic synergy assays. A value of <0.5 indicates synergy while a value of >4 indicates antagonism. "ND" represents "Not Done."

	Tobramycin	**Oxacillin**
M-E,12,12	0.708	1.09
M-DMAP,12,12	0.917	0.909
M-IQ,12,12	0.625	0.704
M-4PP,12,12	0.664	0.915
PX 2,8 2	0.501	0.506
PX 2,10 2	0.69	ND

Discussion

Dialkyl 4,4'-bipyridium amphiphiles with linker lengths varying from 6-12 carbons, were studied to determine if linker length affected MIC values. As linker length increased, MIC values increased, for *E. faecalis* and *S. aureus*. This type of relationship has been described with other amphiphiles as well Palermo *et al,* 2012 .

Since linker length is correlated with activity of the amphiphile, it is reasonable to assume that as the linker length increases, the flexibility of the amphiphile increases, thus allowing the amphiphile to penetrate the cell membrane of the bacteria more effectively. As the head groups attach to the membrane of the bacterial cell, the linkers may help drive the amphiphile through the membrane to induce cell lysis of the bacterial membrane Lombardo *et al,* 2015 .

The compounds with longer linker lengths were more effective at disrupting the Gram-positive membranes, resulting in lower MICs. Gram-negative bacteria are generally less penetrable by antimicrobials because they have two lipid bilayer membranes with a tightly packed lipid polysaccharide LPS layer in the outer membrane Khalil *et al.*, 2008 , consistent with generally higher MIC values.

Synergy between cationic amphiphiles and antibiotics on *E. coli* was investigated. Although there was not synergy with any of these combinations, synergy has been observed with other compounds of similar structure. Other studies have indicated that amphiphiles can increase effectiveness of antibiotics Purdy *et al,* 2009 , and will be investigated further.

There are several avenues of investigation that could broaden this study. First, studies on increased linker length would be reasonable. Combination therapies were explored in this study, but further investigation should be done because synergy between amphiphiles and antibiotics has been documented Purdy *et al,* 2009 . The rate of killing of these amphiphiles is also worth further research because developing a potent amphiphile that works quickly would be preferable for product development. Such endeavors would help expand the understanding of structural features that optimize the antibacterial activity of dialkyl 4,4'-bipyridium amphiphiles.

When developing antimicrobials for disinfectant purposes, it is very important to consider the factors that affect resistance in order to combat healthcare-acquired infections. It is important that the antibacterial agent does not harm eukaryotic cells. A parallel avenue to study would be to determine the toxicity of these amphiphiles on eukaryotic cells. Ideally, a disinfectant would selectively target bacterial membranes, which would be of great interests to hospitals in preventing healthcare-acquired infections. Medical professionals must stop over-prescribing antibiotics that are ineffective against bacteria and embrace effective antiseptics and disinfectants such as amphiphiles. While bacteria are becoming increasing resistant to commercially available antimicrobials, research is moving towards novel approaches to combat antibiotic resistance and amphiphiles are one avenue worth exploring.

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Uncrowning: Degradation of Sovereignty in Flann O'Brien's *At Swim-Two-Birds* and Rabelais' *Gargantua and Pantagruel*

Abstract

Uncrowning is a term used by literary critic Mikhail Bakhtin to describe the ritual degradation of sovereignty in order to rejuvenate the folk culture. This paper studies the Bakhtinian motif of uncrowning in Flann O'Brien's *At Swim-Two-Birds* and Rabelais' *Gargantua and Pantagruel*, written nearly four hundred years apart. When this method is applied, one finds many similarities between the two novels, including beatings, verbal abuse, dismemberment and loss of status which result in a cultural rebirth and renewal. These commonalities have biblical, classical and mythological roots, and are reflected in both ancient and modern literature. The application of Bakhtinian themes to modern literature has become more common in recent years, and his importance as a literary scholar has grown. Bakhtin is especially useful in this paper to discern common themes and tropes which may then be examined, compared and discussed in those terms.

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Biography

I graduated from the University of Central Oklahoma with a B.A. in Humanities, minor in History, in May 2016, after transferring from University of California, Los Angeles. This paper was written for a capstone on Mikhail Bakhtin, and used for my Humanities Capstone requirement. It won Best Paper at the Liberal Arts Symposium at UCO in 2016. I am currently enrolled in the M.A. program at UCO where my research focus is medieval Celtic literary history. I have also completed coursework at the University of Edinburgh and the University of Wales. After completing graduate study, I plan to become a professor.

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Uncrowning: Degradation of Sovereignty in Flann O'Brien's *At Swim-Two-Birds* and Rabelais' *Gargantua and Pantagruel*

At first glance, it may seem that Flann O'Brien's *At Swim-Two-Birds* and Rabelais' *Gargantua and Pantagruel* have little in common. The first is a novel written in 1940 by an Irishman; the second, a series of novels written by a 16th century Frenchman. The subjects are also diverse: *At Swim-Two-Birds* is about novelists and their characters, a fine example of metafiction. *Gargantua and Pantagruel*, written between c.1532-c.1564, recounts the adventures of two giants and reflects the religious and nationalistic conflicts of Rabelais' time. Despite obvious differences of time and culture, both the authors and novels have similarities; for example, understanding of both novels benefits from an application of the theories of Mikhail Bakhtin who is known primarily for his theories of the carnivalesque and grotesque realism as applied to literature. Bakhtin asserts that the human spirit is renewed when freed from the strictures of official culture through these methods. This liberation occurs primarily from the communal aspect of folk culture, drawn from medieval times, and uses themes like the carnivalesque and the grotesque to break down and renew the communal culture—the folk. Bakhtin also uses the motifs of debasement and beatings used to liberate the folk from official culture: kings and the crown, priests and the Church. This degradation of sovereignty is termed "uncrowning" and involves abuse, either physical or linguistic, which debases and also renews the folk culture. This Bakhtinian cycle of degradation and renewal is seen in both *Gargantua and Pantagruel* and *At Swim-Two-Birds*. In Gargantua and Pantagruel, Rabelais uses uncrowning in the episodes concerning Anarchus and Picrochole; O'Brien uses the uncrowning of Sweeny and Trellis in a similar way in *At Swim-Two Birds*.

As well as uncrowning, there are other similarities between the authors and novels. Both Rabelais and O'Brien are masters of language, flexing their linguistic muscles to find new and exciting ways to use words. Rabelais uses fanciful and emotive language to make a point: "The probity that scintillizes in the superfices of your persons informs my ratiocinating faculty, in a most stupendous manner, of the radiant virtues latent within the precious caskets and ventricles of your minds" Rabelais, Book V, Chapter V . O'Brien performs linguistic feats with Classical overtones. When Trellis is sent to court in *At Swim-Two-Birds,* his Greek *pro bono* attorneys are Timothy Danaos and Dona Ferentes. This is a transliteration of Virgil's *"Timeo Danaos et dona ferentes"* commonly translated as "Beware of Greeks bearing gifts" Virgil, II, 49 .

Neither book is easy, light reading; there are layers and more layers to most every scene. Both novels are critically acclaimed. Both authors work through the political and religious conflicts of their different times in these novels: for O'Brien, Irish nationalism and rejection of England; for Rabelais, European nationalism and rejection of Rome. Bakhtin, writing in the Marxist Soviet Union, was also working through political and religious conflicts in his own country, which can be seen in his great study of Rabelais. Despite relative obscurity during his lifetime, Mikhail Bakhtin's importance is increasingly recognized by the modern audience. Once translated, *Rabelais and His World* with its theory of ritual inversions of sovereignty through grotesque realism and the carnivalesque stimulated scholars in the diverse fields of history, folklore, linguistics and anthropology. Bakhtin's analysis of Renaissance social constructs is valuable because it may as easily be applied to both more ancient and more modern societies, and his work is researched and referenced often by modern scholars.

Bakhtin's analysis of *Gargantua and Pantagruel* in terms of Menippean satire recalls classical parodists, like Lucian and Apuleius. Prose satire of this type was ignored as a popular style for many years, but it has made resurgence recently. Among modern works, these influences are again visible, as exemplified in the work of Flann O'Brien, T.S. Eliot's *The Waste Land,* Douglas Adams' *The Hitchhiker's Guide to the Galaxy,* Lewis Carroll's *Alice's Adventures in Wonderland,* and Kurt Vonnegut's *Cat's Cradle.*

These works, primarily novels, have several historical commonalities. One such is a reliance on traditional narrative, written or oral, as exemplified in a grotesque yet comic character. The folk recognize the story and the character trope on a very deep, even primitive, level. This recognition causes them to respond to the satire in a visceral way, which allows it to serve the purpose of inverting social hierarchies and order in a regenerative manner. This process is necessary to the human psyche as it has been utilized in a recognizable way throughout recorded history. Another commonality is the use of comedy generally and satire specifically to take down certain types of personages through ridicule, such as government or church officials, bourgeois intellectuals, parvenus, hypocrites and bigots. There are many historical and literary examples of this method: for example, the Fool or Jester character, various "Kings" of Carnival season and mock civic and church ceremonies like those at Oxford and Cambridge in the Renaissance period Cobban 206 . Bakhtin categorizes this type of satire as necessary and life-affirming to the culture engaging in it. His work attracted the attention of young Russian philosophers and literati; with them, Bakhtin formed the Bakhtin Circle.

The Bakhtin Circle is a school of thinkers who first met in 1918 in Belarus; their research centered on the work of Bakhtin which addressed the socio-cultural issues posed by the Russian Revolution and the formation of the Soviet Union. The primary themes of the group are that language is essentially dialogic, or formed within a social framework, and that the speech used carries traits of the culture both of those uttering and those hearing it. The official culture attempts to claim a single language or usage as proper, and the rest subversions. In this linguistic realm, the novel is seen as the highest form of social critique IEP . The same uncrowning theme of inversion may be seen here using language style: official language versus the unofficial language of the folk in the marketplace. Official culture may be ritually destroyed by mocking and subverting its official language, and the subversion of common language rejuvenates the common culture.

Bakhtin's insight into the needs and motivations of people, both ancient and modern, is being used by modern scholars in a variety of ways. Academics in multiple disciplines are publishing about Bakhtin in the fields of philosophy, psychology, language, literature and history. The Bakhtin Centre at

Sheffield University was founded in 1994 originally to promote inter- and multi-disciplinary research about Mikhail Bakhtin and the Bakhtin Circle. It has grown to encompass the study of Russian and Soviet culture, and related fields. The Bakhtin Centre hosts conferences, provides research fellowships and sponsors study of Bakhtin and his worldwide influence. The 15th Annual International Bakhtin Conference was held in Stockholm in July, 2014. It featured dozens of papers and lectures on the conference theme of "Bakhtin as Praxis: Academic Production, Artistic Practice and Political Activism." The amount and variety of current scholarship using Bakhtin's work is a sign of his importance in the modern world, and how well the material still informs modern thought.

Mikhail Bakhtin finished *Rabelais and His World* in 1940, under the name *Rabelais in the History of Realism.* This work applies Bakhtin's literary theory and philosophy to Rabelais' *Gargantua and Pantagruel.* He submitted it as his dissertation after failing to get it published for several years. It was published in Russian in 1965 and in English in 1968 with the current title. *Rabelais and His World* is considered a classic in literary theory and Renaissance studies. In *Rabelais,* Bakhtin explores the true nature of man and his relationship to society, noting that after the peak of the Rabelaisian world, man was increasingly subject to the strictures of official culture and language, and the chokehold of the bourgeoisie with its prim and judgmental morality. In order to escape, to be free, man needed a communal and carnivalesque outlet. Bakhtin's carnival is an "other time" recalling the communal medieval festival time, when authority is mocked and degraded by the folk. At festival time, unofficial culture ruled. During Carnival, mocking abuse is not wholly negative; rather, it is ambivalent and always has a positive, regenerative aspect. In *Rabelais and his World,* the Introduction states:

> Thus, one of the key qualities of the Carnival is degradation, the degrading of what is official and revered, mocking it and transferring it to the realm of the unofficial. But, Bakhtin is careful to note, this degradation is always in the interest of making something new.
>
> 'To degrade is to bury,' Bakhtin writes, 'to sow, and to kill simultaneously, in order to bring forth something more and better. Degradation digs a bodily grave for a new birth: it has not only a destructive, negative aspect, but also a regenerating one' Bakhtin 21 .

Although Bakhtin was a Marxist, there is something Christian about uncrowning; a fall of man motif, along with the mockery of Christ as King, which can be seen in some examples of uncrowning, and is mentioned by Bakhtin as well Bakhtin 198 . Applying the Bakhtinian theory of uncrowning by abuse and degradation to make something new to *Gargantua and Pantagruel* and *At Swim-Two-Birds* gives a greater understanding of each. Both Rabelais and O'Brien use Bakhtin's uncrowning motif to illustrate a cycle of death and renewal, of change being a function of the passage of time, and of the hope for a future free from fear which is embodied by the folk.

In *Pantagruel* (book 1 , Rabelais describes the defeat of the Dipsodes and the capture of their King, Anarchus. While celebrating the victory, Epistemon, recently revived by Panurge after being beheaded, relates to the party how society was organized according to occupation and social standing in the Elysian Fields. Epistemon told that all who had been high during earthly life were brought low in the afterlife, and vice versa; for example, Cleopatra in hell was an onion crier and Pope Urban a bacon picker. In true Bakhtinian topsy-turvy fashion, those who had been poorly treated on earth were great successes in the afterlife; for example, Diogenes strutted about in purple with a golden scepter Rabelais 147-150 . As the companions celebrated, they noticed that their prisoner, King Anarchus, was not enjoying himself. Pantagruel decided to give his care over to Panurge.

Remembering what Epistemon said about the treatment of the very high in the afterlife, Panurge determined that Anarchus needed an occupation suitable to his future fate after death, so that he would be properly prepared. Panurge stripped him of his royal dress and found him a livery of varicolored clothing, like a fool's garb, with a little bonnet adorned with feathers. Dressed in this way, Anarchus is named a crier of green sauce by Panurge who forces him to practice plying his trade in front of Pantagruel and the party Rabelais 154-155 . Pantagruel pinches his ear and reminds him that he has never been so happy not being a king Rabelais 155 . After two days, Panurge finds an appropriate wife for Anarchus, no longer a king, but a crier of green sauce. His bride is called a "well-nicked strumpet" Rabelais 155 , and Panurge throws a wedding feast for the married couple with loads of food and drink, dancing, music and merriment. Pantagruel sets the couple up in a small house, and it is said that the wife beats Anarchus mercilessly but he is so weak and pitiful he does not even defend himself Rabelais 155 . For Bakhtin, this type of abuse unmasks the king and turns him into an object of mockery and pity, a clown; examples of this are repeated in both Rabelais and O'Brien Bakhtin 197 .

After Anarchus' uncrowning and degradation, the people of the Dipsodes are joyful and turn the city over to Pantagruel, aside from the Almyrodes who required further encouragement. Looking at this episode from a Bakhtinian viewpoint, the abuse of Anarchus was merry and liberating to the people and his loss of sovereignty and debasement resulted in new life and nearly communal agreement going forward. Bakhtin discusses the particular pleasure to be taken in uncrowning the very high, which can be seen in both Rabelais and O'Brien Bakhtin 305 .

In *Gargantua* Book 2 , King Picrochole is described as the stereotypical evil ruler: he is choleric, selfish and ambitious Kushner 309 . He also makes poor judgments. The name Picrochole comes from the Greek *pikros* meaning "bitter" and *chole* meaning "bile" Online . Rabelais sets him up as the antithesis of the archetypal good king, Gargantua's father, Grandgousier. After quarreling with some of Grandgousier's citizens, Picrochole decides to attack and a war ensues despite Grandgousier's desire for peace and good living.

Gargantua attacks King Picrochole at La Roche Clermault, and defeats his army. Picrochole erroneously believed help was coming, and took many risks before admitting that the cause was hopeless. He and his men ran away in every direction; Gargantua and his army followed, slaying every man they found. As Picrochole fled, his horse stumbled, and in a fit of rage, he foolishly kills it. There were no other mounts to be had, so he tried to steal a miller's donkey, but the millers "showered him with blows," took his clothing, and garbed him only in a poor smock Rabelais 353 . Picrochole in misery and anger continues on his way, telling his sad story to everyone he meets, hoping that a fortune teller's prediction of his kingdom returning to him would come to pass. He is thought to be a penny laborer in Lyons. After his victory, Gargantua spoke to Picrochole's defeated men, promising that he had no bad intentions and would leave the kingdom to Picrochole's son.

This scene describes another Bakhtinian uncrowning by the people. Picrochole is abused and beaten by the folk, and demeaned from his role as king to that of a poor day laborer owning only a smock to cover himself Bakhtin 212 . The king is a pretender. Despite this, Picrochole maintains his visions of grandeur, but the people are allowed to put this past behind them and carry forward with a new rule, guided by fairness and good will. The carnivalesque demands the death and burial of the old in order to give life and hope to the future, in this case, through uncrowning. Picrochole bears all the characteristics of a bad king, corrupted by power, separated from the people and isolated in the official culture. By contrast, Gargantua, and through him, his chosen heir to Picrochole, gives hope to the communal people, and the future, by debasing and symbolically burying the evil kingship. This type of symbolic death and burial is renewing and allows the people to turn the fear of death propitiated by official culture into a fearless and joyful participation in the circle of life, where death is necessary for birth to occur.

Similar Bakhtinian uncrowning themes are seen in O'Brien's *At Swim-Two-Birds,* though it is written four hundred years after *Gargantua and Pantagruel.* In *At Swim-Two-Birds*, O'Brien uncrowns the mythological King Sweeny and the protagonist of his autobiographical novel, the virtual god Dermot Trellis Comer 105 . Though this novel is more modern, both O'Brien and Rabelais lean on classical learning and classical scholarship for their sources and characters; in O'Brien's case, the classical learning is Old and Middle Irish, and the scholarship is the Irish mythologies.

The character of Sweeny in *At Swim-Two-Birds*, as well as the title of the novel, is taken wholesale from the Old Irish *Buile Suibhne*. Sweeny is one of three characters O'Brien takes from Irish mythology another being Finn Mac Cumhaill . Sweeny's tale is told by Finn as he and some of Trellis' other characters are sitting around the fire telling stories. O'Brien uses the actual text of *Buile Suibhne* in Finn's retelling, a translation done by the author himself O'Hainle 39-43 . *Buile Suibhne* is a mishmash of legends and tales attached to the character of Suibhne, King of Dal nAraidi compiled in the twelfth century *Book of Leinster.* Though O'Brien, much like his narrator in *At Swim-Two-Birds,* was inconsistent in his studies, he did have a deep familiarity, respect and care for the Irish language and culture Anspaugh 4 . The title "*At Swim-Two-Birds*" is a literal translation of *Buile Suibhne's* "Snámh dá Én", a place where the mythological Suibhne landed as a bird-man *Buile* folio 85a line 474 .

Sweeny occurs twice in *At Swim-Two-Birds*; first as the mythological king whose story is told by Finn, and second as another hired character in Trellis' novel. The Sweeny/Suibhne of mythology is a foe of Christianity; as such, he assaults St. Ronan twice, first breaking his bell, then throwing his psalter into a lake. An otter returns the psalter, but Sweeny takes no heed of this implicit message, and the next day kills Ronan's assistant. Ronan laid curses upon Sweeny on all three occasions, to the effect that Sweeny is condemned to wander the land mad and unclothed, living as a bird among the trees. Since he is not in fact a bird, Sweeny suffers from the elements, hunger and thirst, injuries and falls, and is eventually redeemed by St. Moling, at which point Sweeny is killed by a shepherd with a spear Foster 6 . In this tale, Sweeny as king is uncrowned by curses and degradation. Instead of living as a king, he is condemned to live as a bird-man; neither bird nor man, he is a grotesque compilation that affords neither comfort nor peace. As bird, he is injured repeatedly by thorny branches and falls, and as man, he is denied all humanity and human comfort.

Sweeny's second appearance comes when he is hired as a character in Trellis' novel, a cautionary tale about the wages of sin. In this novel, Sweeny is an example of what happens to sinners when he is brought back to life and made to suffer all of his indignities again for Trellis, this time involving an actual fall when he crashes down from his perch in a tree. This fall, or uncrowning, may be compared with man's fall in Genesis, as well as the Bakhtinian life from death, regeneration from degradation motif Foster 6 . This motif is repeated with Trellis' fall below. In both mentions, Sweeny is a pagan king who violently opposes the rise of Christianity. Since in ancient times, paganism as exemplified by Sweeny was the official culture that was dying, and Christianity the new, regenerative and life-affirming future, Sweeny and paganism needed to be uncrowned. Using a Bakhtinian point of view, Sweeny in both cases is sovereignty and official culture that must be abused and degraded in order to liberate the folk and allow hope and regeneration to flourish. Additionally, there is a Christian thread in the Sweeny character which may also be seen as an uncrowning…the mock crowning of Christ in the gospel is reminiscent of the thorn wounds that Sweeny suffers as a bird-man, and the mockery of him as a past king Bakhtin 198 .

Dermot Trellis, himself a novelist, is the protagonist of O'Brien's narrator's novel. Trellis is a rather careless and malicious man, who has a strange flaw: he loves to read but limits himself to reading only books with green covers. As an Irishman, this tilts his knowledge base heavily to Irish literature and culture; his particular interest is religion and virtue. He is also familiar with Western novels. Trellis is writing a book about how to live a virtuous and ethical life, primarily using examples of the exact opposite for instructive purposes. He creates some of his characters, and borrows others, among them Sweeny and Finn from ancient history and mythology as above. The third mythological character in the novel is the Pooka, a devil figure from Irish folklore, here exemplifying Satan. All of Trellis' characters, both created and borrowed, are hired as characters forced to do his bidding and live in the Red Swan Hotel with him Downum 307 . The characters become resentful of Trellis' control and manipulation, and eventually determine to keep him asleep most of the time so they can live their own lives, only snapping back to their story arcs when Trellis is awake. This works for some time, until the unholy union of Trellis with one of his creations results in the birth of a fully-grown man, Orlick Trellis, whose soul by arrangement belongs to the Devil. Orlick is a writer like his father, and with Orlick's dark propensities, Trellis' characters see a way to get rid of their god-like oppressor once and for all.

Orlick writes a book with help from the characters in which Trellis himself is a character, therefore trapping him and making him subject to the communal will. Trellis is uncrowned in a scene of epic violence, directed by the Pooka, whereby he is beaten, abused, threatened and dismembered. On top of it all, Trellis is mocked and made to claim he is enjoying the process O'Brien ASTB 189-193 .

At one point in the beating, the Pooka asks Trellis if he would like a kick in the face. Trellis replies "of course", and the Pooka "lifted half of the man's face off with one kick and sent it high up into the trees" O'Brien ASTB 198 . The Pooka demands that Trellis say he likes it, and Trellis replies "'Certainly I like it'…through a hole in the head – he had no choice because orders is orders to quote a well-known tag. 'Why wouldn't I like it, I think it's grand'" O'Brien ASTB 198 . Trellis exemplifies official culture for the characters of his novel; he is controlling, threatening and is a follower of rules. One of Trellis' injuries is a fall from a second-story window which is a fall of man motif as above. Trellis also receives a wound in the left chest, another Christian allusion O'Brien ASTB 193 . The dismemberment Trellis suffers during his uncrowning is reminiscent of that discussed by Bakhtin. At one point, noticing one of Trellis' backbones laying on the ground, the Pooka demands that Trellis pick it up and carry it along so nothing gets lost, certainly a comic image in Rabelaisian style.

Bakhtinian uncrowning motifs are an important commonality to consider when reviewing Rabelais' *Gargantua and Pantagruel* and Flann O'Brien's *At Swim-Two-Birds.* Although it would be clear to most readers that both novels are comic and satiric, and both deal with social and religious themes, viewing them with a Bakhtinian eye shows deeper links between them which contribute to a greater understanding of both works. The life-affirming and regenerative nature of Bakhtin's uncrowning via abuse and beatings gives a unique point of reference when reading Rabelais and O'Brien. These authors are not simply satirizing or commenting on issues, but are using a framework of uncrowning motifs that have shown the triumph of the folk over oppressive official culture for hundreds of years.

Bakhtin and O'Brien are roughly contemporary, though one lived in Marxist Russia and the other in Catholic Ireland. Rabelais lived much earlier, and was definitely read by O'Brien as well, though he seems to have found Rabelais lacking in the innate Irish sense of doom and tragedy. Of Irish author James Joyce, O'Brien wrote, "With a laugh he palliates the sense of doom that is the heritage of the Irish Catholic. True humour needs this background urgency: Rabelais is funny, but his stuff cloys. His stuff lacks tragedy" O'Brien SP 175 . Perhaps Rabelais' perceived optimism came from the times he lived in, or perhaps O'Brien chose to view himself and the Irish as more hopeless than was true. Both authors, however, use uncrowning in a Bakhtinian manner to show not just the death and burial of the old, but the hope and regeneration of the new. There is an understanding among Rabelais, O'Brien and Bakhtin that this cycle of death and regeneration, uncrowning and renewal is cyclical and bound up with time. A Greek phrase from Euripedes' *Heracles* begins *At Swim-Two-Birds* which translates "for all things change, making way for each other" O'Brien ASTB and Bakhtin writes that "time is the hero of every feast" Bakhtin 219 . Comedy, tragedy, or both, *Gargantua and Pantagruel* and *At Swim-Two-Birds* use Bakhtin's uncrowning by degradation as a life-affirming and hopeful renewal for the people.

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Relations between Measures of Media Consumption and Fat Phobia

Abstract

Fat-phobic attitudes and behaviors have been reported in numerous settings and are associated with both physical and psychological consequences for those affected. While past research points to media being predictive of fat-phobic beliefs and behavior, studies using a comprehensive, non-weight-specific media variable are still needed. Identifying media's role in fat phobia is important in better informing interventions targeting this problem. In the present study, we hypothesized that the amount of media people consume predicts their level of fat phobia. A sample of 105 college students completed a survey including four media subscales and five full or partial outcome measures. While there were three correlations that were significant and between a predictor and criterion, regression analyses were not performed due to the predictors being irrelevant to our hypotheses. The lack of findings in support of our research hypotheses suggests that media may only be predictive of fat phobia when the content is specifically body- or weight-related. Consumers are encouraged to be mindful of the impact body-specific media messages may have on their perceptions of others.

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Relations between Measures of Media Consumption and Fat Phobia

Fat phobia, or the “pathological fear of fatness,” encompasses both externalized anti-fat prejudice and the internalized form, i.e., fear of becoming or remaining fat due to weight stigmatization in society Robinson, Bacon,   O’Reilly, 1993, p. 468 .[1] Behavioral and attitudinal manifestations of fat phobia have been documented in numerous professional and personal settings Bernard, Nathalie,   Klein, 2014; Lozano-Sufrategui, Carless, Pringle, Sparkes,   McKenna, 2016; Puhl et al., 2015; Vartanian, Smyth,   Pinkus, 2016 . Given that over two-thirds of American adults meet the medical criteria for overweight or obesity BMI ≥ 25, BMI ≥ 30 , fat phobia is especially relevant here see Table 53 of U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, 2017 . Studies show that the portrayal of fat people in media influences fat phobia in those exposed Eisenberg, Carlson-McGuire, Gollust,   Neumark-Sztainer, 2015; Grabe, Hyde,   Ward, 2008; Lydecker et al., 2016 . The goal of the present study is to further the research on media’s role in fat phobia to better inform interventions targeting this problem.

Terminology

Fat phobia is often buried under the large body of research on constructs such as weight bias, weight stigmatization, and weight discrimination. For the purposes of this study, discussion of these terms will henceforth abide by the following definitions to avoid confusion in interpreting the literature.

Weight stigmatization and fat phobia

Weight stigmatization, or stigma, refers to the social devaluation of fat individuals as evidenced by anti-fat bias and discrimination Russell-Mayhew, McVey, Bardick,   Ireland, 2012; Daníelsdóttir, O’Brien,   Ciao, 2010 . It can be either internalized self-directed or externalized directed toward others; Durso   Latner, 2008; Link   Phelan, 2001 and is at the epicenter of fat phobia. Fat phobia, or fear of fat, stems in part from the prospect of being stigmatized or undervalued because of one’s body size Fahs   Swank, 2017; Wellman, Araiza, Newell,   McCoy, 2017 . Weight stigma can be viewed as the process by which fat phobia is made visible.

Internalized weight stigma and body dissatisfaction

The internalized form of weight stigma, also known as self-directed stigma or weight bias internalization, involves the projection of anti-fat beliefs and stereotypes onto oneself rather than on others Durso   Latner, 2008; Pearl, White,   Grilo, 2014 . Body dissatisfaction, referring to negative perceptions of one’s own body, is the way in which internalized weight stigma often manifests Carels et al., 2013 .

Externalized weight stigma: Anti-fat bias and weight discrimination

Externalized weight stigma can be either cognitive or behavioral, the behavioral form manifesting as weight discrimination Link   Phelan, 2001 –the differential negative treatment or exclusion of fat people Carr   Friedman, 2005; Sutin   Terracciano, 2017 . Anti-fat bias is the cognitive form of externalized weight stigma and refers to the negative attitudes, opinions, and stereotypes held about fat people Daníelsdóttir et al., 2010; Tate, 2010 . Weight discrimination is almost always consciously or subconsciously preceded and accompanied by anti-fat bias Tate, 2010 . In the present study, fat phobia is the overarching term due to its recognition of fear as a driving force and its embodiment of the other terms discussed.

The Problem

Fat people are regularly stigmatized and discriminated against by potential employers and health professionals, as well as by people in their everyday lives, such as colleagues, acquaintances, and strangers Bernard et al., 2014; Lozano-Sufrategui et al., 2016; Puhl et al., 2015; Vartanian et al., 2016 . Despite evidence of the relation between weight and health being mediated by stigma itself, society's perception and treatment of fat people has yet to change Bacon Aphramor, 2011; Hunger Major, 2015; Major, Hunger, Bunyan, Miller, 2014; Puhl Latner, 2007; Tomiyama et al., 2014; Vartanian et al., 2016; Wellman et al., 2017 . Vartanian et al. 2016 asked participants of normal, overweight, and obese BMI classifications to document their experiences of weight stigma as they occurred. Results revealed that participants reported approximately 11 incidences of weight stigma over 14 days. These numbers are problematic considering the psychological and physiological outcomes associated with fat phobia. Specifically, internalization of weight stigma is linked to lower self-esteem, depression, anxiety, body dissatisfaction, binge eating, chronic dieting, and exercise avoidance Friedman, Ashmore, Applegate, 2008; Lawrence, 2010; Puhl Latner, 2007; Russell-Mayhew et al., 2012; Vartanian Novak, 2011; Vartanian et al., 2016 , as well as higher levels of cortisol and oxidative stress Schvey, Puhl, Brownell, 2014; Tomiyama et al., 2014 . In the present study, further identifying or discounting predictors of fat phobia is hoped to aid prevention of these outcomes.

Media's Role in Fat Phobia

Fat-phobic messages and situations have been widely documented in media forms such as TV shows, movies, literature, social media platforms, and news sources Ata Thompson, 2010; Eisenberg et al., 2015; Greenberg, Eastin, Hofschire, Lachlan, Brownell, 2003; Herbozo, Tantleff-Dunn, Gokee-Larose, Thompson, 2004; Himes Thompson, 2007; Latner, Rosewall, Simmonds, 2007; Lydecker et al., 2016; Previte Gurrieri, 2015 . For example, Eisenberg et al. 2015 analyzed 30 episodes from highly-rated TV shows and identified incidents of weight stigma in half of the episodes examined. News media has similarly been implicated in perpetuating weight stigma by referring to fat individuals using negative and degrading terms Previte Gurrieri, 2015 . Unfortunately, research has demonstrated that viewers of weight-stigmatizing media often internalize the fat-phobic messages presented.

The portrayal of fat individuals in media or experimental conditions has been shown to play a role in reinforcing and increasing fat-phobic beliefs in those exposed Eisenberg et al., 2015; Grabe, Hyde, Ward, 2008; Lydecker et al., 2016; McClure, Puhl, Heuer, 2011; Puhl, Luedicke, Heuer, 2013 . Grabe et al. 2008 conducted a meta-analysis of 77 articles examining the association between media and body-image-related disturbances. Results supported the hypothesized relations between amounts of media consumed and body dissatisfaction, thin-ideal internalization, and disordered eating behaviors and beliefs. However, implications of the calculated effect sizes may be misleading because much of the research on media's relation to fat phobia focuses specifically on body-related content Fikkan Rothblum, 2012; Grabe et al., 2008; Karsay Schmuck, 2017; McClure et al., 2011; Puhl et al., 2013 . Even in correlational studies, researchers often measure exposure to what Grabe et al. 2008 call "thin-ideal media," or media known to be saturated with pro-thin and anti-fat messages, such as television and fashion magazines p. 462 . As a considerable amount of the experimental and correlational research included in Grabe et al.'s meta-analysis utilized body-related media, analysis of the relation between overall media consumption and fat phobia is likely to yield different results 2008 . The current study is intended to fill this research gap by using a comprehensive, neutral media measure as a predictor of fat phobia.

Hypotheses and Rationale

The present study seeks to determine whether media consumption is predictive of fat phobia as operationalized by negative stereotypes about fat people, internalized weight stigma, and anti-fat bias. Identifying media's role in fat phobia is hoped to better inform interventions targeting the associated outcomes.

Anti-fat stereotyping

Fat people regularly bear the brunt of both positive and negative stereotypes regarding their character and behavior, e.g., insecure, no willpower, overeater, friendly, and humorous Robinson et al., 1993 . Furthermore, research has implicated media in the perpetuation of anti-fat stereotypes McClure et al., 2011; Puhl et al., 2013 . We hypothesized that the amount of media people consume predicts their level of anti-fat stereotyping.

Internalized weight stigma

Studies have demonstrated exposure to weight-stigmatizing media to be positively associated with levels of body dissatisfaction Grabe et al., 2008, Jaeger Câmara, 2015 . In the present study, the amount of media people consume is hypothesized to predict internalization of weight stigma.

Anti-fat bias

Exposure to media containing weight-stigmatizing incidents has been linked to heightened anti-fat bias in viewers Fikkan Rothblum, 2012; Karsay Schmuck, 2017; McClure et al., 2011; Puhl et al., 2013 . We hypothesize that the amount of media people consume predicts their level of anti-fat bias.

Method

Participants

Convenience sampling was used to recruit participants for this study. A brief description of the study's requirements was handed out on slips of paper to students in psychology classes at Columbus State University. The recruitment slips contained instructions for logging into SONA, the Department of Psychology's Research Participation system, to schedule a time to complete the survey in-person. The original sample contained 111 participants, six of which were excluded from analysis due to not completing at least two-thirds of each subscale. Participants were all awarded one point of SONA extra credit for keeping their appointment, regardless of the percentage they completed.

The final sample consisted of 105 participants, the majority of which were female n 78 . No participants identified as being transgender or "other" for the gender identity question see Table 1 . Ages ranged from 18 to 49 years old M   20.35; SD   3.82 . 5.7% as Asian e.g., Chinese, Vietnamese, Korean, Pakistani, etc. , 48.6% as Black/African American, 37.1 % as White/European American, 6.7% as mixed race, and 1.9% "[preferred] not to answer."

Hispanic identity, defined as a person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture, regardless of race, was 91% Not Hispanic or Latino and 14% Hispanic or Latino. In the survey, 38 participants classified themselves as freshmen first year , 34 as sophomores second year , 21 as juniors third year , 10 as seniors fourth year , and two as "other."

Measures

Media and technology usage and attitudes scale MTUAS

Rosen, Whaling, Carrier, Cheever, and Rokkum 2013 created the Media and Technology Usage and Activities Scale MTUAS in response to concerns that previous media consumption measures fell short in the way of being comprehensive and reflective of current media trends. The MTUAS was created with eleven subscales, the aggregation of which examined both usage frequency and attitudes toward media. Four of the subscales were used in this study due to their perceived relevance to the hypotheses: TV Viewing 2 items; α   .61 , Media Sharing 4 items; α   .84 , Media Usage 9 items; α   .97; Rosen et al., 2013 . Subscale items were worded in terms of activity frequency e.g., "how often do you..." , varying only in the specific activities described e.g., "watch [ing] TV shows, movies, etc. on a TV set" . All items were scored on a 10-point interval scale with 1 indicating never and 10 indicating all the time. Subscale reliability when used with the present sample was as follows: TV Viewing α   .41 , Media Sharing α   .63 , Internet Searching α   .83 , and General Social Media Usage α   .90 .

Fat phobia

Three measures were used to assess manifestations of participants' fat phobia: Restricted Activities Scale, Fat Phobia Scale-Short Form, and Universal Measure of Bias- Fat.

Restricted activities scale REACT

Robinson and Bacon 1989 created the Restricted Activities Scale REACT scale as part of a treatment program targeting body image and self-esteem as cited in Robinson   Bacon, 1996 . The items are all prompted by the statement, "how I feel about my weight, body shape, or size prevents or would prevent me from..." An example of an item on the scale is "wearing form-fitting or 'sexy' clothes." The instrument consists of ten subscales, three of which were used in the present study. All items were scored on a five-point Likert scale where higher scores indicated more self-imposed restrictions. The measure achieved excellent reliability α   .97 when a sample of 52 was used Robinson   Bacon, 1996 . The present study utilized the Appearance 6 items , Emotional 6 items , and Social Activities 5 items subscales. Cronbach's alpha for each subscale in the present study was .90, .93, and .95, respectively.

Fat phobia scale-short form FPS-Short Form

Bacon, Scheltema, and Robinson 2001 created the Fat phobia scale in the short form FPS-Short form as a part of a revisit of a study on the stereotypical and prejudicial attitudes directed toward fat people. This survey is a condensed version of the original 50-item survey Robinson et al., 1993 . Pairs of adjectives based off anti-fat stereotypes e.g., “lazy” or “industrious” were presented with instructions to indicate on a 5-point scale where fat or obese individuals would fall. The measure achieved excellent reliability 14 items, α .91; Bacon et al., 2001 . Use of the instrument with the present sample n 105 yielded a Cronbach’s alpha of .87.

Universal measure of bias- fat UMB-FAT

The UMB was developed to measure and analyze bias against fat, gay, and Muslim individuals Latner, O’Brien, Durso, Brinkman, MacDonald, 2008 . The version targeting fat people was used in this study. The 20 survey items are rated on a 7-point Likert scale from strongly agree to strongly disagree. An example of an item on the UMB-FAT is “fat people are sloppy.” The measure achieved notable reliability α .87; Latner et al., 2008 . In the present study, Cronbach’s alpha was .87.

Procedure

Before participants took the survey, they were required to read an electronic informed consent form. The form described the purpose of the study, what was involved, potential risks, potential benefits, any costs or compensation, confidentiality, and withdrawal procedures. Participants were required to agree that they had read the form before continuing to the survey.

Participants completed the survey on computers in room 117 of the Faculty Office Building FOB of Columbus State University. Once the participants arrived at the test site, they sat down at one of the eight available computers. With four rows containing two computers each, up to six participants could complete the survey at once. The researcher present collected the participants’ SONA I.D.s, directed them to a computer, and gave debriefing slips to the participants after completion of the survey. Following providing informed consent, participants were asked about their gender identity, age, race, Hispanic identity, and year in college. A survey examining media and technology usage followed, examining categories such as television, Internet, and social media. The survey concluded with three outcome variable measures: internalized weight stigma REACT Scale , anti-fat stereotyping FPS-Short Form , and anti-fat bias UMB-FAT . The survey took less than thirty minutes to complete.

Once responses were submitted, participants were debriefed on the full purpose of the study. Information for seeking services from the University Counseling Center was included. Participants had the option of requesting follow-up information about the study by emailing the primary investigator. Extra credit points were distributed to participants within 48 hours of participating. All analyses were performed using the Statistical Package for the Social Sciences SPSS software.

Results

The final sample size for the study was 105. The average fat phobia level was low-to-moderate for all outcome variables examined see Table 2 . To test our hypotheses regarding media consumption predicting anti-fat stereotyping, anti-fat bias, and internalized weight stigma, we planned to perform hierarchical linear regression. The variables for this study were not normally distributed, failing multiple normality tests such as the Shapiro-Wilk test, skewness, and interquartile range vs. standard deviation, thus leading to the use of nonparametric tests. Spearman’s rho correlations were performed using SPSS and overall yielded non-significant findings. Three significant correlations existed between a predictor and criterion: television viewing TV to anti-fat bias, rs 103 -0.19, p .05, TV to the appearance subscale of our internalized-weight-stigma measure, rs 103 0.20, p .04, and general social media usage to anti-fat stereotyping, rs 103 0.22, p .03 see Table 3 . The correlations were weak and irrelevant to our hypotheses as we were not interested in whether specifically TV viewing or social media usage predicted the outcome variables. Therefore, the planned regression analyses were not performed. Based on the obtained results, there was not enough evidence to suggest that the amount of media people consume is related to their level of fat phobia.

Discussion

In the present study, we were interested in whether the amount and frequency of people's media consumption predicts their level of fat phobia. Fat phobia was assessed using a composite of full and partial measures: Fat Phobia Scale-Short Form; Restricted Activities subscales appearance, emotional, and social ; and Universal Measure of Bias-fat. While regression analyses were not performed, correlations indicated that media consumption, specifically as an aggregate of four subscales, was not significantly correlated with any of the three outcome variables. The following subsections examine the present findings in the context of the literature and speculate as to why this misalignment may have occurred.

Media vs. Anti-Fat Stereotyping

The negative stereotyping of fat bodies has long been used as entertainment in popular media. Greenberg et al. 2003 analyzed 210 hours of TV programs to determine whether there was an association between characters' body types and the way they were portrayed. Characters classified as "larger" were less often portrayed as attractive or as having positive personality traits p. 1344 . Several studies have found anti-fat stereotyping to be a source of amusement in media, be it through making fun of fat individuals or making jokes related to fatness Burmeister Carels, 2014; Fouts Burggraf, 2000; Greenberg et al., 2003; Himes Thompson, 2007; Yoo Kim, 2012 . Given the number of articles reporting anti-fat stereotypes in media, we expected that people's media consumption would predict their internalization of said stereotypes. Two experimental studies related to our hypotheses sought to determine whether this was the case.

In an experiment conducted by McClure et al. 2011 , participants reported higher levels of anti-fat stereotyping when exposed to stereotypically negative images of fat people than when presented with more positive images, despite the accompanying text being neutral. These findings are similar to those of Puhl et al.'s 2013 study in which participants exposed to negative photos of fat people were more likely to object to socializing with the person pictured and to report anti-fat attitudes and stereotyping. As was used in the present study, both experiments utilized the Fat Phobia Scale-Short Form to measure perceptions of fat people. Despite using the same fat phobia measure, the present study did not find media to be predictive of anti-fat stereotyping. While McClure et al. 2011 and Puhl et al.'s 2013 experiments both yielded significant effects of media portrayal on fat phobia levels, no predictive equivalent was found in the present study. This lack of alignment may be attributed to their use of an experimental design in which media was a manipulated condition rather than a survey measure. Furthermore, the experiments' media conditions were specifically related to the portrayal of fat individuals, whereas the present study utilized a broad media measure with the goal of examining frequency. Additional research in which the amount of media consumed is assessed in relation to anti-fat stereotyping is needed.

Media vs. Internalized Weight Stigma

We hypothesized that the amount of media people consume would predict their internalization of weight stigma. The Restricted Activities scale was used to test this hypothesis and examines whether body dissatisfaction would prevent people from engaging in certain activities, regardless of the participant's actual weight. In other words, the measure examines fat phobia both from a perspective of "if I disliked my body" and "because I dislike my body," according to the participant's body image.

As part of the Restricted Activities scale, respondents had the opportunity to disclose ways they personally felt restricted by their body image. A total of 31 personal responses were provided in which participants disclosed that their body image either prevented or would prevent them from being photographed, exercising in public, and experiencing happiness see Table 4 . While a relatively small number when compared to the overall sample, these responses nonetheless exemplify internalized weight stigma and the associated body dissatisfaction Carels et al., 2013; Durso   Latner, 2008 . Still, the inclusion of these participants in analyses was not enough to yield a significant correlation between the REACT scale and media consumption.

Despite there being research demonstrating a link between body dissatisfaction and media Davison, Schmalz, Young,   Birch, 2008; Forbes et al., 2005; Friedman et al., 2008 , no such relations were found in this study. It is worth noting that the Restricted Activities scale has never been used in relation to media prior to this study. Consequently, the hypothesized relation between media and internalized weight stigma was based on studies using different outcome measures Grabe et al., 2008, Jaeger   Câmara, 2015 . Even for studies examining body dissatisfaction in place of the Restricted Activities scale, media measures similar to the present were not used. It is therefore difficult to make a reliable comparison between the present findings and those of previous studies. Future studies using the Restricted Activities scale as a function of media are needed to draw any further conclusions.

Media vs. Bias Against Fat People

The presence of weight bias in media has been well established. A plethora of studies have documented the number of mediums, programs, episodes, and incidences containing weight bias Ata   Thompson, 2010; Eisenberg et al., 2015; Herbozo et al., 2004; Lydecker et al., 2016; Grabe et al., 2008 . However, much of the research on media's relation to anti-fat bias focuses on media content specifically related to weight, i.e., the content most likely to correlate with bias Fikkan   Rothblum, 2012; Karsay   Schmuck, 2017; McClure et al., 2011; Puhl et al., 2013 . This reality gives insight into why the present findings do not align with those in the literature. The Media and Technology Usage and Attitudes Scale is not content-specific, but instead covers a variety of media forms with a focus on frequency Rosen et al., 2013 . Additional studies using comprehensive, frequency-based media measures in relation to fat phobia would be useful in solidifying media's role.

Limitations

A limitation faced in this study was the sample population. The sample consisted of students at Columbus State University who were enrolled in at least one psychology course. Such likely affected our results because this sample is not representative of the population. College campuses typically contain students between 18 and 24 years old, with exceptions. The mean age of participants in this study was 21, thus limiting the generalizability of the results. Additionally, 75% of participants were females, making it difficult to accurately say that anything found is consistent between genders.

Another limitation faced was the lack of an attention-check question in the survey. When creating the survey, we failed to include attention-check questions which would have ensured that participants were not selecting answers at random. This also would have helped to determine which participants, if any, did not answer honestly or were inattentive during the survey.

Future Directions

In future studies that use a similar design as the present study, a suggested change would be to utilize a more inclusive media usage survey. A more in-depth version of Media and Technology Usage and Attitudes Scale that is updated and inclusive of the expanding varieties of media would be advisable. For many, watching something on a television set also involves the Internet. There are a multitude of streaming services and media players that provide services allowing one to watch a wide variety of media without a television plan, e.g., Netflix, Hulu, ChromeCast, and Amazon Fire Stick. Additionally, in an age where most everything is on the Internet and social media is inclusive of multiple platforms, a media usage survey should be specific as to what forms of media are included in which category. If a future survey had similar items, it might be beneficial to add an explanation of what should be included or excluded for different subscales. For example, social media includes Facebook, Twitter, LinkedIn, Instagram, YouTube, Tumblr, and Reddit, among others. Asking someone without a Facebook account how often they check Facebook may yield misleading results if that person does have a Twitter or another social media profile. Therefore, the current results may not accurately reflect our participants' actual media usage.

Examining the relation between participants' body satisfaction and answers to the survey questions may be useful. Participants could also specify where they feel their weight lies, e.g., underweight, average weight, overweight, or obese. While there are established BMI ranges for each of these classifications, it may be difficult for a person without a medical background to gauge where they fall. Participants may also feel uncomfortable disclosing their actual weight, thus further justifying use of more subjective size markers.

Implications

The relation between the portrayal, or lack thereof, of fat individuals in media and public opinions about fat people has been established Fikkan Rothblum, 2012 . Fat individuals are often excluded from media, the exceptions tending to involve unflattering depictions Fouts Burggraf, 2000; Greenberg et al., 2003; Himes Thompson, 2007 . Shifting this portrayal from a negative to a positive light may similarly influence consumers' attitudes toward fat people Pearl, Puhl, Brownell, 2012 . As media producers become more conscious of the influence of this portrayal on viewers, it would ideally become a new standard to change the way different weight classes are portrayed. For example, the methods used to attain the thin bodies so often portrayed in media are rarely visible to the people watching. In order to protect consumers, media executives should refrain from over-representing thin artists and associated lifestyle behaviors in their content. Casting a wider range of body types would help make the content more relatable to consumers who do not meet the thin-ideal standard.

On an individual level, people may also use this study to help them make different choices regarding media use. The knowledge of media's association with internalized weight stigma and the accompanying mental health outcomes may motivate people to limit the amount of weight-stigmatizing and thin ideal media consumed. Furthermore, individuals can share information on the outcomes associated with fat phobia with others in their circle. This awareness may help people limit their perpetuation and internalization of weight-stigmatizing messages.

Conclusion

In contrast with previous research, the current study did not yield any evidence in support of a relation between overall quantity of media consumed and fat phobia. This misalignment may be attributed to the differences in media variables used. Much of the literature on fat phobia and media focuses on media specifically containing weight-stigmatizing incidents Fikkan Rothblum, 2012; Grabe et al., 2008; Karsay Schmuck, 2017; McClure et al., 2011; Puhl et al., 2013 . The present findings may indicate that media is only predictive of fat phobia when the content specifically relates to weight. Rather than focusing on the amount of media consumed, more closely monitoring the messages conveyed in media may help prevent the outcomes associated with fat phobia. Those in the psychology field can use these findings to pinpoint where in affected clients' lives fat-phobic messages are likely being communicated. On a personal level, individuals can practice lessening their intake of weight-stigmatizing media so as to prevent unwanted internalization of those messages. Consumers of media are advised to consider the impact content may have on their perceptions of themselves and others.

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Footnotes

The National Association to Advance Fat Acceptance NAAFA advocates using the term fat as a neutral descriptor of body size rather than overweight or obese. The latter terms are used as markers of morbidity and are thus inconsistent with the fat-acceptance agenda. This study uses the term fat in support of NAAFA's work in ending weight stigmatization.

Table 1

Demographics of the sample and percentage of total participants.

	n	Percent
Gender		
Male	27	25.70
Female	78	74.30
Race		
Asian	6	5.70
Black	51	48.60
White	39	37.10
Mixed race	7	6.70
Prefer Not to Answer	2	1.90
Hispanic Identify		
Hispanic	14	13.30
Not Hispanic	91	86.70
Year in College		
Freshman	38	36.20
Sophomore	34	32.40
Junior	21	20.00
Senior	10	9.50
Other	2	1.90
Total participants	105	

Note. The variance of the total sample and the distribution of race are attributed to participants who selected more than one race.

Table 2

Summary of sample sizes, means, and standard deviations of data from all scales.

	n	*M*	*SD*
Media and Technology Usage and Attitudes Scale MTUAS	105	5.32	1.08
TV Viewing	105	4.09	1.67
Media Sharing	105	3.87	1.41
Internet Searching	105	6.20	1.67
General Social Media Usage	105	5.85	1.58
Restricted Activities Scale REACT	105	1.20	0.96
Appearance	105	1.25	1.08
Emotional	105	1.45	1.13
Social Activities	104	0.82	1.01
Fat Phobia Scale-Short Form FPS-Short Form	105	2.90	0.68
Universal measure of bias- fat UMB-FAT	105	2.4700	0.70

Note. The variation in sample size for the Social Activities subscale is the result of participants not completing at least two-thirds of this subscale.

Table 3

Summary of intercorrelations between scores on the MTUAS aggregate and sub-scales, REACT aggregate and subscales, FPS-Short Form, and UMB-fat.

Measure	1	2	3	4	5	6	7	8	9	10
1. MTU-AS										
2. TV	0.39									
3. MS	0.47	0.27								
4. IS	0.66	0.29	0.32							
5. SMU	0.81	0.06	0.15	0.31						
6. FPS	0.18	-0.11	0.15	0.13	0.22					
7. UMB	-0.16	-0.19	0.06	-0.06	0.05	0.11				
8. RE-ACT	0.07	0.14	0.06	0.03	0.01	0.09	-0.05			
9. APP	0.13	0.20	0.14	0.00	0.06	0.00	-0.04	0.91		
10. EMO	-0.04	0.05	-0.02	-0.02	-0.06	0.10	-0.05	0.91	0.72	
11. SOC	0.06	0.06	0.08	0.06	0.05	0.18	-0.03	0.82	0.64	0.70

Note. The aggregate of the REACT and the MTUAS subscales are in bold. TV Television viewing; MS Media sharing; IS Internet searching; SMU General social media usage; MTUAS Media and Technology Usage and Attitudes Scale; FPS Fat Phobia Scale- Short Form; UMB Universal Measure of Bias- Fat; APP Appearance; EMO Emotional; SOC Social Activities; REACT Restricted Activities scale.
p <.10. p < .05.

Table 4

Responses to the REACT subscale questions.

Subscale	Responses
Q1. How I feel about my weight, body shape or size prevents or would prevent me from other appearance-related activities.	
Appearance	
	Participating in public events
	Posting selfies or videos of myself
	Jogging in front of others
	Eyebrows waxed
	Handbags, dying my hair sometimes, mani/pedis, facials, undergar-ments
	Taking pictures
	Model for someone
	Working out in a gym, modeling
	Posing for pictures with friends and family or posting to social media
	Workout five days a week, mainly for stress relief rather than body image
	Clothing for a party/event
	Selfies
	Anything showing skin
Q2. How I feel about my weight, body shape or size prevents or would prevent me from other ways of being limited emotionally.	
Emotional	
	Feeling insecure about my body shape and worried I don't satisfy my significant other
	Like I'm not allowed to be angry. I have to be happy and supportive.
	If I do not feel confident about the way I feel or look that day then I will more than likely not feel the best.
	Possibly feeling like you are not good enough for some people
	Being around different groups of people
	Being happy in general or feeling like I fit in with my friends

Q3. How I feel about my weight, body shape or size prevents or would prevent me from other social activities.

Social Activity	
	Events held on the college campus
	Family socials
	Going places with my boyfriend's friends
	Not being as activity as I was like going dancing, sporting events and activities, etc.
	Campus activities, other activities such as going to the park, out to eat, bowling, etc.
	Meet and greets
	Sports
	Sports, which I used to love to compete in
	I'm a heavy set dude so going to the beach is not really my speed considering dude with 6 pack abs
	Going out to eat
	Social sports
	There are always a lot of people and that is when I try to avoid activities

The Effects of Acetone and Histidine on the Viability of Astrocytes

Abstract

Astrocytes are major glial cells in the central nervous system CNS . Current research is focused on the relation between these glial cells and diseases, specifically Parkinson’s disease. Parkinson’s disease may be caused by astrocytes Halliday Stevens, 2011 . The blood-brain barrier is maintained, and glial cell line-derived neurotrophic factor GDNF is produced by astrocytes. In Parkinson’s patients, the blood-brain barrier is disturbed and dopaminergic receptors significantly reduced possibly due to the lack of GDNF Gray Woulfe, 2015 . Using acetone, ketoacidosis can be simulated *in vitro*; studies have linked ketoacidosis to the development of cerebral edema and eventually to Parkinson s disease. In the present study, acetone in 1% and 5% concentrations were administered to astrocytes to simulate ketoacidosis. We measured cell viability with trypan blue and a hemocytometer. Further, histidine was used in 1% and 5% concentration to observe its neuroprotective effects on astrocytes. Results were insignificant based on a two-way ANOVA due to the small sample size of the astrocytes. Implications of this study would allow for observation of astrocytes in the pathogenesis of Parkinson’s and other neuronal diseases.

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Biography

Nicholas Wilson is a third-year chemistry major at Columbus State University. With interest in biomedical research, his current research aims towards different cellular mechanisms in the human body. Special acknowledgement goes to Dr. Kathleen Hughes, professor of biology at Columbus State University, who facilitated and supervised this research.

Citation Style: APA Format

Disciplinary Category: Biology

The Effects of Acetone and Histidine on the Viability of Astrocytes

Astrocytes, star-shaped glial cells located in the central nervous system, account for 20-40% of glial cells in the CNS Sandvig, Berry, Barrett, Butt, Logan, 2004 . Developmentally, astrocytes are formed from clusters of progenitor cells with WNT and Fibroblast Growth Factor FGF acting mainly as the signaling factors in the development of astrocytes Rowitch, D. H., Kriegstein, 2010 . Early positioning and localization of astrocytes into domains of the brain, which have been denoted as p1, p2, and p3, leads to eventual astrocyte developmental differentiation. Each domain provides its own unique transcription factors PAX6/NKX6.1 or different cell surface markers reelin or SLIT1 to the astrocytes. Generally, the spindle-like processes of the astrocytes envelop the synapses of the neurons.

The three main groups of astrocytes, protoplasmic, fibrous, and radial, differ in their structure and function. Typically, protoplasmic astrocytes are the most numerous and are characterized by their presence in grey matter accompanied by their tertiary processes with many organelles present Bergström Forsberg-Nilsson, 2012 . Fibrous astrocytes are found in white matter and exhibit long, single processes with few organelles. Radial astrocytes are localized in perpendicular axes to the neural ventricles and are mostly involved in neuronal development. All astrocytes contain glial fibrillary acidic protein GFAP , an intermediate filament that plays a role in the cell communication of astrocytes, and GDNF, a protein that is responsible for the viability of neuronal cells and aids in the development of the blood-brain barrier Figley Stroman, 2011 .

Aside from radial astrocytes which mainly operate during development, fibrous and protoplasmic astrocytes operate similarly within the CNS. Both are mainly involved in the electrical transmission of impulses within the brain. Astrocytes have been demonstrated to be reactive towards glutamate and gamma-aminobutyric acid GABA ; it is believed that some astrocytes have neurotransmitter transporters that allow for the movement of these molecules Santello Volterra, 2008 . Moreover, astrocytes have been demonstrated to regulate ion concentration, in particular calcium and potassium. In their nuclei, astrocytes can hold glycogen to allow for glycogenesis or can provide lactate to surrounding cells for nutrition. Interestingly, astrocytes have been shown to affect surrounding neuronal cells by modulating synaptic transmission of neurons and forming a glial scar in an area of nervous tissue damage Faulkner et al., 2004 .

Needless to say, astrocytes serve important functions within the CNS. Some of the current research is focused on the relation between these glial cells and diseases, specifically Parkinson’s Disease. Parkinson’s Disease, a neurodegenerative disorder that is characterized by loss of motor functions in over 6.2 million people worldwide, is potentially caused by astrocytes Halliday et al., 2011 . Although no known or identifiable environmental or genetic factor predisposes sufferers to the disease, current research has been centered on astrocyte degeneration Booth et al., 2017 . In several studies, an important commonality in Parkinson’s sufferers is the loss of dopaminergic neurons in the substantia nigra para compacta Martin Waszczak, 1996 . As mentioned earlier, the blood-brain barrier is maintained and GDNF produced by astrocytes. In Parkinson's patients, the blood-brain barrier has been disturbed, and dopaminergic receptors have been significantly reduced possibly due to the lack of GDNF Gray Woulfe, 2015 .

Acetone, a polar and aprotic solvent, is commonly produced by the body as a result of the decarboxylation of ketone bodies Kalapos, 1999 . High concentrations of ketones can cause ketoacidosis which results in acetone formation in bodily tissue; this condition is usually caused by the insulin deficiency in diabetes or the inability to synthesize a sufficient amount of glucose in excessive alcohol consumption. In several studies, the link between diabetic ketoacidosis and cerebral edema has been documented and indicates a positive correlation between the concentration of ketones within the brain and the likelihood of contracting cerebral edema Taubin Matz., 1968 . Yet, it has not been determined if astrocytes are specifically targeted by the ketone bodies or if ketones impact other neuronal cells. Cerebral edema, a condition that is characterized by the swelling of the brain due to excess fluid, has been linked to be the blood-brain barrier. It is believed that cerebral edema can be caused by the degradation of the blood -brain barrier which is maintained by astrocytes Stokum, Kurland, Gerzanich, Simard, 2015 . Cerebral edema has been found in several Parkinson's disease patients due to the disruption of the blood-brain barrier Kim Vemuganti, 2017 . In the present study, astrocytes were exposed to acetone to simulate ketoacidosis within the body. Significant damage and death to these astrocytes would suggest that the blood-brain barrier may be compromised in its efficiency, which could cause cerebral edema, and increase in the chance of developing cerebral edema is followed by an increase in the chance of developing Parkinson's disease. Astrocyte samples were exposed to 1% and 5% acetone concentrations to determine if acetone affects astrocytes and causes Parkinson's disease. To determine the viability of the cells, trypan blue was used, with blue indicating cell death and white indicating that the cell was alive.

Histidine, a positively charged amino acid, has been found to have significant effects on neuronal cells. In several studies, histidine was shown to have neuroprotective properties that aided in the viability of astrocytes Bae Majid, 2013 . Although the exact mechanism is not completely understood, it is generally believed that the H1 and H2 receptors are involved for this protection. Further, histidine has been demonstrated to ameliorate brain edema Li, Han, He. 1995 .

This study performs an in vitro analysis of astrocytes that are exposed to acetone and histidine. As discussed, dying astrocytes are implicated in diseases such as Parkinson's. Comparatively, astrocytes were also exposed to varying concentrations of histidine to observe the immunomodulatory effects of the amino acid on the cells.

Method

Materials and Procedure

This study was performed by using six separate wells of astrocytes were incubated in a carbon dioxide incubator. Handling of the astrocytes occurred under a sterilized fume hood. The solutions to treat the astrocytes were 1% and 5% histidine, 1% and 5% acetone, and distilled water. On the first day, 100µL of each of the six solutions were deposited into one of the six wells that contained the astrocytes.

On the second day, the media were removed from each of the six wells and decanted into a waste container. At this point, a minimal amount of media remained in each of the wells. Trypsin 1 mL was added to each well to detach the astrocytes from the sides of the well. Using a light microscope, the cells were observed and remained in the trypsin until they were detached and could move freely.

The trypsin and cells were then transferred to a microcentrifuge tube. The cells were centrifuged at 3000 rpm for three minutes to pellet the cells. The supernatant of the trypsin was removed through decantation which left a cell pellet in each microcentrifuge tube. The pellet was resuspended in 50µL media by pipetting the media up and down. Trypan blue 50µL was added to each of the six microcentrifuge tube. Using a hemocytometer, the cells were counted in the four squares.

Results

Pictures of the trypan blue treatment of the astrocytes that were exposed to the varying concentrations of acetone, histidine, and distilled water have been provided and are available upon request Figure 1 . Blue indicates dying cells, and white indicates cells that are alive. Pictures are included in the appendix of this manuscript. Raw data is provided Table 1 as well as the summarized two-way ANOVA report and its graphical representation. To measure significance between groups, cell viability percent, which was calculated by amount of living cells divided by total cells counted, was used.

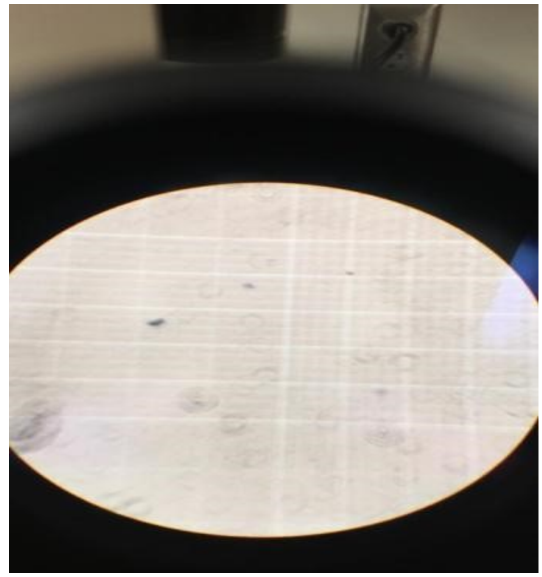


Figure 1. Figure of astrocytes stained with trypan blue. Trypan blue and a hemocytometer were used to count astrocytes in order to measure cell viability.

Discussion

Due to the insignificance of the results, cell viability percent between astrocytes treated with acetone and histidine showed no statistical difference when comparing cell viability percent. Through reading previous studies, histidine provides significant long-term neuroprotection to astrocytes Liao et al., 2015 . With this previous finding and the expected result in the decreased cell viability of astrocytes exposed to acetone, the insignificance of the current study suggests experimental design flaw. From the reported raw data, a trend can be seen which suggests astrocyte degradation when exposed to acetone and astrocyte durability when exposed to histidine.

Table 1
Measured Cell Viability

Treatment	Cells Alive	Cells Dead	Total Cell Count	Cell Viability Percent
First Control of 100µL of distilled water	2.0×10^{5} cells/mL	1.8×10^{5} cells/mL	3.8×10^{5} cells/mL	66.60%
Second Control of 100µL of distilled water	2.6×10^{5} cells/mL	2.2×10^{5} cells/mL	4.8×10^{5} cells/mL	54.20%
1% Acetone	4.0×10^{4} cells/mL	2.0×10^{5} cells/mL	2.4×10^{5} cells/mL	16.60%
5% Acetone	6.0×10^{4} cells/mL	4.5×10^{5} cells/mL	5.1×10^{5} cells/mL	11.70%
1% Histidine	2.2×10^{5} cells/mL	1.6×10^{5} cells/mL	3.8×10^{5} cells/mL	57.90%
5% Histidine	4.4×10^{5} cells/mL	2.0×10^{5} cells/mL	4.8×10^{5} cells/mL	91.60%

Between-Subjects Factors

		N
Concentration	0	2
	1	2
	5	2
Substance	1	2
	2	2
	3	2

Descriptive Statistics

Dependent Variable:Percent

Concentration	Substance	Mean	Std. Deviation	N
0	1	60.40	8.768	2
	Total	60.40	8.768	2
1	2	16.60	.	1
	3	57.90	.	1
	Total	37.25	29.204	2
5	2	11.70	.	1
	3	91.60	.	1
	Total	51.65	56.498	2
Total	1	60.40	8.768	2
	2	14.15	3.465	2
	3	74.75	23.829	2
	Total	49.77	30.556	6

Levene's Test of Equality of Error Variances[a]

Dependent Variable:Percent

F	df1	df2	Sig.
.	4	1	.

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Concentration + Substance + Concentration * Substance

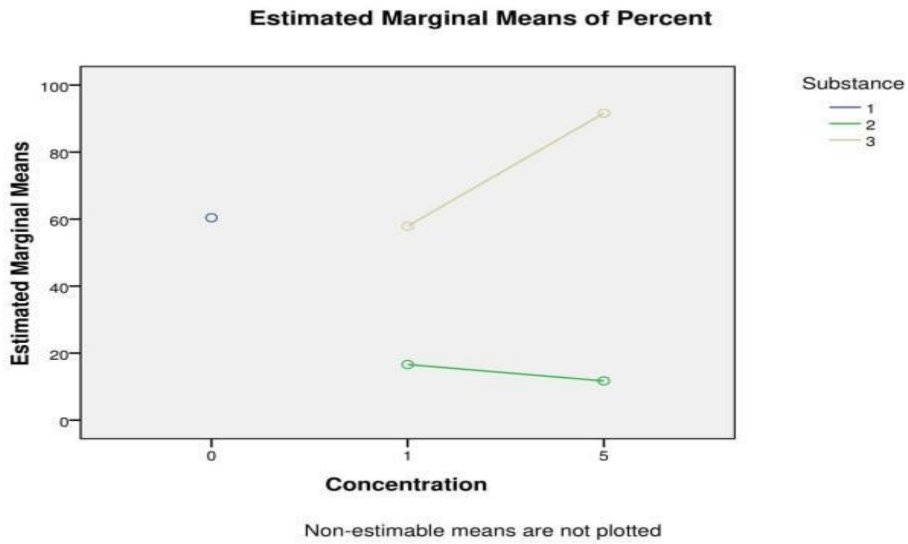
Tests of Between-Subjects Effects

Dependent Variable:Percent

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4591.413[a]	4	1147.853	14.930	.191
Intercept	14389.550	1	14389.550	187.169	.046
Concentration	207.360	1	207.360	2.697	.348

a. R Squared = .984 (Adjusted R Squared = .918)

Figure 2. Summarized ANOVA report. This figure was taken from the two-way ANOVA report that was performed using IBM SPSS. The figure details the sample size of the treatments and shows significance to be greater than 0.05 yielding the results as insignificant. The standard deviations and means of the groups are provided as well.

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UNIANOVA Percent BY Concentration Substance
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /PLOT=PROFILE(Concentration*Substance)
  /EMMEANS=TABLES(Concentration) COMPARE ADJ(LSD)
  /EMMEANS=TABLES(Substance) COMPARE ADJ(LSD)
  /EMMEANS=TABLES(Concentration*Substance)
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  /CRITERIA=ALPHA(.05)
  /DESIGN=Concentration Substance Concentration*Substance.
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Univariate Analysis of Variance

Figure 3. Estimated marginal means of percent of cell viability percent. The yellow line represents the astrocytes exposed to histidine, the green line are the astrocytes exposed to acetone, and the blue dot is the control. With estimated marginal means cell viability percent the Y-axis, a marginal difference in viability between acetone and histidine can be noted, but it does not yield a significant difference.

Limitations

Due to the limited timeframe of this project, several limitations were presented throughout its duration. Using a hemocytometer and trypan blue, the astrocytes were counted. Unfortunately, this method could allow for erroneous reporting of results due to the possibility of miscounting cells or misidentifying the viability of a cell. As such, a flow cytometer would have more accurately measured cell viability because of its increased sensitivity to cell specimens. Further, the low sample size of the astrocyte treatments did not allow for adequate statistical power.

Future Directions

From these results, the question of the significant impact of acetone and histidine when incubated with astrocytes has yet to be concluded. Future designs of this project should include more accurate reporting of astrocyte viability. Further, in vivo studies can be attempted in laboratory animals to better understand the pathogenesis astrocytes may cause when subjected to acetone.

Implications

This study investigated if astrocytes are affected by acetone and histidine. If the astrocytes were unaffected by the acetone, then astrocytes may not play a role in Parkinson's disease and vice versa. Implications of this study could allow for improved treatment of Parkinson's disease by modeling medications that can directly target dying astrocytes. Further, astrocytes can be used to observe if they play a role in other neuronal diseases. In regards to histidine, this study suggests that utilizing a histaminergic system can be a possible therapeutic strategy for neuronal survival based on its actions on astrocytes.

Conclusion

In this study, acetone and histidine were compared at different concentrations in their effects on the cell viability of astrocytes. Both acetone and histidine were provided in either a 1% or 5% concentration to the astrocytes. Using trypan blue and a hemocytometer, the astrocytes were counted to determine their viability when exposed to the different treatments. Results yielded insignificant due to low sample size. Implications from this study can elicit further work into the relation between astrocytes and Parkinson's or other neurodegenerative diseases.

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Perspective: Finding the Luck of the Irish

Abstract

Traveling around Ireland for two weeks has taught me values such as appreciation, open-mindedness, and kindness. The cultural and educational experiences that I have shared with my group are lifelong learning experiences and are truly unforgettable. Not only did I find the luck of the Irish on this trip with the incredible people I met and the delicious food I ate, but I also found that this journey solidified my passion for business and contributed to the growth of my education and career.

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Biography

Gabrielle Chan is a Senior at Columbus State University currently pursuing a degree in Marketing in the Tuner College of Business. She hopes to graduate in Fall 2018 and go on to pursue her MBA. She has a passion for traveling and learning about the different cultures of the world. With the Honors College she hopes to graduate with research that utilizes her experience in international business and marketing.

Category: International Studies

Perspective: Finding the Luck of the Irish

Ireland was never at the top of my bucket list for traveling. However, the more I researched about the country, the more I fell in love with it. My decision to study abroad was purely obligatory as it would satisfy my Honors College requirement. However, my indifference towards Ireland evolved into fondness as I immersed myself in the community and culture. I learned how to appreciate other cultures and conduct myself in business settings in a respectable manner. I have also made lifelong friends who will be able to reflect on this experience with me for years to come. The opportunity to explore the culture and everyday life in Ireland combined with the educational learning experiences has not only contributed to my self growth, but also the growth of my undergraduate career.

I signed up for Business in Ireland during Maymester, because as a marketing major, having international business experience is incredibly valuable to me. Our group met a week prior to our flight to learn about the culture and customs of Ireland and the businesses we were going to visit. Before I knew it, I was on an eight hour flight to Dublin, waiting to step foot onto Irish soil and finally being able to explore the beautiful country. During our two week trip, we stayed in four different cities and truly got the Irish experience. For every new city, we began with a walking tour to understand the history as well as note places of interest. While we spent most of our time on required cultural excursions and business presentations, we were given free time to explore by ourselves and find our favorite spots in each city. We stayed in Ireland's capital, Dublin, for the longest duration of time and got to learn all about the cultures and customs of the bustling city. One of the fondest memories I have from Dublin was getting lost and trying to find a park that a group of us had seen earlier in the day. With no Internet and little knowledge of the city, we finally found our destination and had fun being kids again on a playground, conducting photoshoots at sunset.

While Dublin is a bustling city filled with adventures, my favorite city in Ireland would have to be Galway. It is situated near the coast of Ireland and has a warm and relaxing atmosphere. While both Dublin and Galway were heavily populated at the time, the people in Galway seemed more carefree and joyful. From Galway, half of our group took a trip to the Aran Islands where we biked around and marveled at the natural scenery . We saw a variety of terrains on our journey such as cliffs, hilly grasslands, and beaches. After a long and exhausting ride, we finally reached our destination, Dun Aonghasa: the prehistoric fort located at the top of a cliff . Standing on the edge of the cliff, with the sparkling blue Atlantic ocean in front of me and the incredible lush landscape behind me, I truly began to understand and appreciate the beauty of Ireland.

The most important component of study abroad is, of course, the studying. We were all excited to explore a new country, but dreaded having to dress up and sit in countless meetings. However, having the opportunity to meet and interact with the founders of numerous international businesses was the most valuable experience on this trip. The business meetings were incredibly helpful and demonstrated the different ways of conducting business overseas. Ireland increasingly strives to promote startups by offering funds and space for growing businesses. In addition to the funding, space, and professional help, the friendliness of the Irish people and their readiness to help have led them to become one of the best countries in the world to start a business.

One of the most valuable lessons I learned was from observing business people carry themselves in the face of guests. We were merely college students who wanted to have a look inside of a business. However, they treated us as important guests knowing we were the next generation of business owners. Good business is done by going the extra mile: providing refreshments, giving tours, and arranging for transportation. It is not always about the numbers, but about how you present yourself to others.

In the future, I will know how to be culturally sensitive and present myself to others in a way that will leave lasting impressions. Learning about businesses through a class is helpful, but going out and immersing oneself in international businesses is an irreplaceable learning experience. Through both cultural and business trips, I got to experience the culture and customs that were unique to Ireland. Before embarking on our journey to Ireland, we were told the Irish were very proud of their country. Our tour guides in each city spoke of their country with a strong sense of pride, yet were extremely helpful and friendly. With our business trips, we were surprised with how welcoming each company was with our arrival. When we hit the streets of Ireland to explore the city life, we met the Irish sarcasm and wit. Our Irish company never missed an opportunity to take a stab at political leaders and always kept us entertained throughout our trip.

Although we were told about the Irish pride and humor, we did not realize how friendly all the people in Ireland would be. People who saw us struggle with directions would help guide us to our destination and did not show exasperation when I frequently asked them to repeat words that were laced with heavy Irish accents. Above all, the people I had the pleasure of meeting made my trip to Ireland that much more incredible. Their commitment to their work and the pride they had in their country coupled with their warm and inviting presence made this one of the most rewarding experiences of my life.

One of the reasons I enjoy traveling is the opportunity to taste the food of another country. Ireland is widely known for consuming large quantities of potatoes, so it was no surprise that nearly every single meal I had included some type of potato whether it be fries or mashed potatoes. I tried food such as bangers and mash, which is essentially sausage and mash potatoes, Irish stew, which contains meat and potatoes with other vegetables, and the one dish that was the most common was fish and chips. Considering the proximity and history that Ireland has with the UK, it is no wonder that fish and chips was a very common item on menus in Ireland.

The Irish do enjoy their potatoes, but they place even more importance on their beer. As the founding place of Guinness, the people of Ireland take pride in their beer more than anything in the country. Our tour in the Guinness Storehouse allowed us to understand how Guinness has impacted the economy of Ireland and how it brought the people of Ireland together. The tour guide even taught us how to pour the perfect pint of Guinness!

Lastly, this journey would not have been as great if it were not for the incredible friends that I made.

At orientation, I realized that I actually knew most of the people who were going on the trip, but the experiences in Ireland have certainly brought us closer together. From late night dance parties, to a tournament of Connect Four in a hotel lounge, the people on this trip have made this study abroad one of the best experiences of my life. Ireland has allowed me to explore a new culture and gain international business insight and experience. The luck of the Irish certainly was present throughout those two weeks abroad, and Ireland will forever be held in my heart as a joyful experience . Studying abroad is certainly one of the best decisions I’ve made, and I know it will have a continual and lasting impact on my life.

The Summer I Fell in Love with the Operating Room

Abstract

This shadowing experience allowed me to get an in-depth observation on the daily operations of surgeons in many fields including general, plastic, vascular, cardiothoracic, orthopedic, and gynecology. I learned about surgical techniques, operating room procedures, and the relationship between surgeons and other medical professionals. This experience was invaluable to my path to medical school and my desire to pursue a surgical career.

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Biography

Caroline Murphy is a Senior psychology-major with a concentration in premedical studies at Columbus State University. Her research interests include cultural syndromes within incarcerated populations and student biases towards professors. She plans to attend medical school in 2020 to pursue her dream to become a surgeon. In her spare time she enjoys binge-watching The Office and playing with her Pomeranian, Chewy.

Category: Enrichment

The Summer I Fell in Love with the Operating Room

I met the general surgeon I would be shadowing at his office with a few other students. The meeting was organized by Dr. Kathleen Hughes through her Competitive Premedical Studies Program CPSP so premedical students like myself could ask a practicing surgeon questions about medical school, residency, and life as a surgeon. After talking to us for two hours about his journey in the medical field, he offered us this shadowing experience. I am forever grateful to Dr. Hughes, because it was through CPSP that I was able to take advantage of this invaluable opportunity.

I arrived at the hospital before the sun rose on that cool summer morning, nervous yet excited for what was to come. Lost as usual, I spotted a receptionist and asked her where the operating room OR was. I followed her directions and eventually came to a set of securely shut double doors. Realizing they could be opened with an access card, I searched for the closest employee I could pester for access. As I searched for help, I happened upon the general surgeon I would be shadowing for the next month. He greeted me with a smile, and I sighed with relief that he remembered me from the meeting we had a month prior.

He brought me back into the surgical recovery area, directed me to the changing room, and told me to meet him at OR 8. My excitement shot through the roof as I changed into the provided uniform. After some searching, I found the correct one and pushed the door open to find a small, stark-white room with posters and equipment lining the walls and a small table positioned in the center of the room. Surgical technicians worked on paperwork in silence on the opposite side. I tried to greet them with a polite smile, only to realize they could not see my smile through my face mask. After a few minutes, the door opened as technicians wheeled in the first patient.

Once the patient was transferred onto the table, the anesthesiologist went to work putting him to sleep. As I watched the anesthesiologist intubate with ease, I felt a longing to learn and see more. Once the patient was under, the techs began preparing him for surgery. The surgeon entered the room a few minutes later and told me to let someone know if I felt ill or faint at any point.

This precaution made me wonder how many people get ill their first time in the OR and whether I would experience it too. As he made the first incision, I realized I was not going to have any problems being in the OR because I only felt excitement and eager anticipation.

The surgeon began going over the case details with me as he worked. He even positioned me at the head of the table so I could peer over and get a closer look at what he was doing. After he made the first incision, he used a cautery tool for cutting through muscle and organ tissue which gave off a distinct odor that was like nothing I had ever smelled before. However, as time passed the smell did not bother me as much. I could tell by watching his hands maneuver the tools that this was a normal procedure for him. A deft technician worked alongside him, handing him tools before being asked. The surgeon was closing his incision by the time I finally relaxed. He told me that his cases rarely run over an hour, and I found it appealing that general surgeons could have five cases a day, yet still be done by lunch time. The surgeon finished closing, ripped off his sterile gown, gloves, and mask and told me he would see me in fifteen minutes for the next case. In that moment I realized that my back, knees, and feet were killing me! The pain was so severe that it led me to purchase “Salonpas” i.e., medicated patches for aches and pains which I wore for all of the remaining surgeries I observed.

The majority of the procedures I observed this summer were hernia repairs and laparoscopic cholecystectomies lap choles performed by the general surgeon. Laparoscopic surgery is a surgical technique that allows the surgeon to work outside the body through small incisions while watching their progress via a camera that is attached to one of the instruments. I enjoyed watching the lap choles because the camera allowed me to see much of the internal anatomy while the surgeon was working. The camera view showed bright yellow fat tissue wrapped around and covering the gallbladder. Once the fat was maneuvered out of the way, the liver and gallbladder were revealed. Before removing the gallbladder, the end of the common bile duct connected to it had to be stapled closed and severed. Then the surgeon used the cautery to carefully cut away the gallbladder from the liver. A few times, he went too deep and punctured the surface of the gallbladder which caused dark green, almost black, bile to leak into the body cavity which had to be suctioned out. Once the gallbladder was removed, I was able to hold and examine it along with any gallbladder stones that were present. I learned a lot about surgical technique and internal anatomy watching lap choles because of the repetition involved.

A few weeks and many Salonpas patches later, I branched out to observe other specialties which included plastic, gynecology, cardiothoracic, orthopedic, and vascular surgery. I enjoyed watching a hysterectomy because it was robot-assisted. It involved a much bigger machine that I would have thought had a mind of its own had I not seen the surgeon in the corner controlling it. The machine moved with grace and precision; I was in awe at the sophisticated technology we had developed to assist and improve surgical techniques. The most shocking case of the summer was a below-knee amputation caused by an infection that spread to the bone. Due to the case’s gruesome nature, I was concerned that I would get ill, or worse, faint. However, when I imagined what losing a part of a limb would mean for my life I began to experience immense sympathy for the patient rather than illness. As the orthopedic surgeon began working on the leg, it donned on me that bad things are going to happen to people that do not deserve it but as a surgeon you get to ease that pain or save their lives. This realization caused my perception of the surgery to change because the amputation would save the patient from severe pain and ultimately death. This case solidified my desire to become a surgeon because it allowed me to see first-hand how on any given day you could save a life.

This experience opened my eyes to a world I once knew very little about. I was able to examine how nurses, techs, surgeons, and anesthesiologists interact and work as a team to alleviate patients’ pain, discomfort and, in some cases, save lives. I quickly learned how time consuming it is to prep an OR and the importance of maintaining a sterile environment.

I learned so much by simply watching and even more by asking questions. Due to this shadowing experience, I am certain I want to be a surgeon one day.

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